CANADIAN FISHERIES' EXPEDITION, 1914-15

ATLANTIC WATERS OF CANADA

REPORT ON THE COPEPODA OBTAINED IN THE GULF OF ST. LAWRENCE AND ADJACENT WATERS, 1915.

BY

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PRINTED BY ORDER OF PARLIAMENT

OTTAWA
J. DE LABROQUERIE TACHÉ
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1918

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PART I.

The pelagic Copepoda are small Crustacea averaging less than five millimetres in length, whose abundance in the sea is the measure of their importance as a direct source of food-supply for the young of the commercial fishes. In addition, they are pre-eminently the food of the herring which in its turn is preyed upon by larger fishes such as the cod and halibut. Accordingly, the investigation of their distribution as governed by depth, season, currents, salinity, and temperature, is generally recognized as having an economic bearing, for fishes will necessarily assemble in places where their food is plentiful. Much work has been devoted to this subject in recent years, especially in European waters, the general purpose of such investigations being to correlate the movements of these organisms with the seasonal migrations of fishes and with the seasonal variations of currents. In the Naples monograph of the pelagic Copepods (1892), the author, Dr. W. Giesbrecht, remarks that very little information was at that time available for the northern part of the Pacific ocean and for that part of the Atlantic ocean which lies between the 35th and 48th parallels of north latitude. It is convenient to remember that cape Cod is situated a little above 42° N. In Canadian waters there had been no quantitative study of the zooplankton up to the year 1915, but the gulf of Maine and the coastal waters between Nova Scotia and Chesapeake bay have quite recently been thoroughly explored during two seasons, the summers of 1912 and 1913, by the United States fisheries schooner *Grampus*, under the direction of Mr. Henry B. Bigelow.

The investigation has to be conducted along two lines: systematic and hydrographical, which in this case is tantamount to saying qualitative and quantitative. The object of the first method is to identify the species, in itself a matter of no little difficulty, involving many microscopic examinations. The second method seeks to determine their relations to the physical and biological conditions of the local environment. In 1901, Dr. W. M. Wheeler published a systematic report on the free-swimming Copepods of the Woods Hole region. The delimitation of this region was interpreted in a liberal sense so as to include not only Vineyard sound but also Plymouth harbour, Mass., and that part of the Gulf Stream which lies 60 to 80 miles due south of Martha's

Vineyard. The last two localities are within a day's journey of Woods Hole, Plymouth harbour being a boreal locality, whilst the Gulf Stream carries a tropical and subtropical fauna. As the four localities covered by Wheeler are typical of their respective districts, it may be desirable to tabulate his records for facility of reference and comparison. These records relate primarily to the fauna at or near the surface, a fact which may partly account for the absence of such representative boreal species as *Calanus hyperboreus, Euchaeta norvegica,* and *Metridia longa,* which frequent the deeper strata of water around 40 or 50 metres, although they sometimes ascend into the surface layers. They are essentially open-water forms, and it is probable that Plymouth harbour and Vineyard sound are too close to the land for them to find the necessary conditions.

TABLE A.—Wheeler's Records (July 1899).

Gymnoplea.	Woods Hole.	Vineyard Sd.	Plymouth Hr.	Gulf Stream.
1. Calanus finmarchicus		♀ XX		
2. Calanus minor				♀ XX
3. Eucalanus attenuatus				♀ 1
4. Eucalanus monachus				♂ 1
5. Mecynocera clausi				♀ 1
6. Paracalanus parvus				XX
7. Calocalanus pavo				♀ XX
8. Calocalanus plumulosus				♀ X
9. Clausocalanus arcuicornis				XX
10. Centropages typicus	X	X	XX	XX
11. Centropages hamatus	X	X		
12. Centropages bradyi				X
13. Temora longicornis	XX			
14. Metridia lucens (=M. hibernica)	♀ 1		XX	
15. Candacia armata (=Candace pectinata)				XX
16. Labidocera aestiva	XX			
17. Pontella meadii	X			
18. Anomalocera patersoni	X			X
19. Pontellopsis regalis (=Monops regalis)				♂ 1
20. Acartia tonsa	XX		XX	X
21. Tortanus discaudatus (=Corynura bumpusii)	XX(♂XX♀1)	♂ XX		
Podoplea omitted				

X means present. XX means abundant.

Of the two divisions of the free-living Copepods, namely Gymnoplea or Calanoids and Podoplea or Harpacticoids, the former is more directly concerned with the purpose of the present investigation. Of all the species which have passed under review, the one that is most widely distributed and most abundant in the fishery districts is *Calanus finmarchicus,* known to the more observant fishermen as "red feed" or "herring feed". It is part of our problem to deal with this and some other species, not only in the full-grown condition but in such of the stages of early growth as are brought up in the tow-net. Six stages in the postlarval development of *C. finmarchicus* have been specified by Professor Gran (1902) who seems to have been the first to attempt an analysis and interpretation of the mode of occurrence of this species in the Norwegian North Sea, where its superabundance had been previously signalized by G. O. Sars. Gran's six stages, adopted with slight inversion by Damas (1905), may be regarded as typical for the Calanoids as a whole, although in some cases the procedure differs remarkably as regards the details of subdivision and fusion of the abdominal segments Thus, at a certain stage, the young *Metridia* has a four-jointed urosome (hind-body) in either sex; the adult female has a three-jointed urosome through fusion of the first and second segments; the adult male has a five-jointed urosome through

subdivision of the earlier fourth segment. There is a similar sequence of segmentation in *Tortanus*. The development consists of three main periods: embryonic period within the egg; nauplius or larval period comprising six stages; post-larval or copepodid period comprising six stages, of which the sixth is the adult (see Lebour 1916).

TABLE B.—Copepodid Stages of *Calanus* (Damas 1905).

Stages.	Thoracic segments.	Abdominal segments.	Pairs of legs.
I	2	2	2 and rudiments of third pair.
II	3	2	3 " fourth pair.
III	4	2	4 " fifth "
IV	5	3	5
V	5	4	5
VI ♀	5	4	5
VI ♂	5	5	5

At least two other species, of small size, must be regarded as important sources of food for young fishes in the gulf of St. Lawrence, viz, *Pseudocalanus elongatus* which attains a length of 1·5 mm., and *Tortanus discaudatus* (about 2 mm.). The former abounds also in the Norwegian sea, the latter is a characteristic Laurentian species. When these forms and others which are commonly associated with them, *e. g. Temora longicornis* (1·5 mm.) and *Centropages hamatus* (1·5 mm.), occur in such numbers as to overshadow the larger forms, they give the plankton a distinctive character both as to colour and size, the dominant tone after preservation in formalin being a dusky grey, and the individual dimensions aggregating to give the aspect of a microcalanoid plankton. A microcalanoid plankton may also be brought about by the predominance of the young stages of larger species, especially those of *C. finmarchicus*. When the individuals are larger and the dominant colour, before and after preservation, is red, owing to the quantity of red oil in their bodies, the plankton wears a megacalanoid aspect. Such a sample may be composed in varying proportions of *Calanus finmarchicus* (3 to 5 mm.) *C. hyperboreus* (3 to 7 mm.) and *Euchaeta norvegica* (3 to 8 mm). Intermingled with these we find sometimes the white *Metridia longa* which according to Farran (1910) is the "most typically Arctic copepod of whose distribution there is any accurate knowledge" (quoted by Bigelow, 1915, p. 292). The four last-named species are as a general rule limited to the waters north of Cape Cod but *C. finmarchicus* ranges to the south of Nantucket, and *Euchaeta norvegica* was taken from 50-0 fathoms in lat. 40° N., long. 69° 29′ W. (Bigelow, 1915).

Giesbrecht tabulated the species of pelagic copepods under three leading regions: species of the warm region (between 47° N. and 44° S.); species of the northern cold region; species of the southern cold region. He showed that the copepod faunas on opposite sides of the American continent are more nearly related than those of the three hydrographical regions named above. Thus the main faunistic differences appear in following the distribution from the equator to the poles or from the poles to the equator, not from the eastern to the western hemispheres.

Calanus finmarchicus is not only the commonest copepod in eastern Canadian waters and in the North Atlantic coastwise waters generally, but it occurs more abundantly than any other form in the San Diego region where its daily vertical migrations have been studied by C. O. Esterly (1911). According to G. O. Sars (1901) both *C. finmarchicus* and *C. hyperboreus* extend throughout the Polar Sea from Greenland in the west to Behring Strait in the east. He adds that the former species is equally devoured by herring and mackerel and "in some cases, as stated by Prof. Robert Collett, forms almost the exclusive nourishment of one of our greatest whales, *Balae-*

noptera borealis." On account of the up-and-down movements referred to in the preceding paragraph, it becomes important to note the time of day when the hauls are made. The total quantity of *Calanus* present in the column of water filtered through the vertical net at a given station is of more practical concern than the quantity at any particular depth. Esterly found that the maximum abundance ("plurimum") at the surface occurred during evening twilight. The surface, in a quiet sea, is practically deserted during the daylight hours, the plurimum between 6 a.m. and 6 p.m. being located at about 200 fathoms. J. I. Peck (1896) found in Buzzards bay that from sunrise to sunset the copepods desert the surface almost completely. The factors which operate in causing this daily rhythm have been analysed in the case of *Labidocera aestiva* by G. H. Parker (1902). Other cases have been discussed by J. Loeb (1894). At station 48 of the *Michael Sars,* between the Canary islands and the Azores, on May 31, 1901, Dr. Hjort states that "the tow-net at 40 metres contained a mass of red copepods, which were not observed at the surface during the daytime, but suddenly appeared as soon as it grew dark soon after 6 p.m."

In addition to the diurnal there are seasonal migrations. Gran (1902) found off the Norwegian coast from Romsdal to Lofoten, females swarming in April and May over the coastal banks. In August and September great quantities of the young stages (II to IV) are found at the surface. In winter *Calanus* descends into deep water. Gran supposes that the autumnal juniors sink into deep water where they slowly complete their growth and rise again to the surface as the spring adults which then spawn, in Norwegian waters. On the other hand the first haul made by the "Princess" on May 11, 1915, between Prince Edward Island and the Magdalen Islands contained both adults and juniors amidst a swarm of *Pseudocalanus* (see table 1).

According to Giesbrecht's faunistic observations, the distribution of pelagic copepods does not conform to the oceanic currents although these are factors in their dispersal. Beyond a certain point the distribution of *Calanus finmarchicus* does not seem to be determined by ordinary physical factors. In the gulf of Maine this species was taken by the *Grampus* in water at temperatures ranging from 42° to 76° F., but was most abundant between 42° and 50° F. (5·5° to 10° C.). The density of the water in which it was living in swarms varied from 1·024 to 1·027. It was wholly absent in pure Gulf Stream water and in the very fresh water at the mouth of Chesapeake Bay. Bigelow adds that none of the physical constants which were determined in his exploration of 1913 will account for "the scarcity of Calanus in the waters south of New York in July, for the subsurface salinities, temperatures, and densities of many of those stations were well within the range occupied by the species in the gulf of Maine. What the limiting factor is, is one of the numerous questions raised, but not answered, by our cruise." (Bigelow, *op. cit.* 1915, p. 290-291). That the Gulf Stream is no barrier to *C. finmarchicus* in the proper latitude, is shown by the records of *Acadia* station 16, June 1, 1.45 a.m., where the surface copepod haul contained 82 per cent of this species, the temperature exceeding 12° C., and the salinity 35 per thousand.

The factor which determines the limit of southern dispersion of *C. finmarchicus* is clearly neither a simple physical constant nor a single organic tropism. It can only be explained at present in terms of endemicity, which includes the biological factors of food-supply and propagation. The Calani which swarm in and about the gulf of St. Lawrence have not been brought there by the Labrador current but are endemic in the Canadian waters. This is shown not only by the presence of the different stages but by the occasional capture of spawning females, taken in the act of extruding an egg or before the latter has had time to become detached from the body of the parent. This is not a frequent observation but was noted in several instances, viz., *Princess* stations 9 and 17; *Acadia* stations 3, 35, 65, 66, 88; *No. 33* stations 13, 14, 25, 26. Females with spermatophore were seen at *Princess* station 20; *Acadia* stations 66, 79, 85, 86, 87, 89; *No. 33* stations 13, 25, 58, 59, 64.

The endemicity of *C. finmarchicus* in the gulf of St. Lawrence being thus proved, it remains to consider its habit of assembling in swarms, in other words its gregarious

habit. The records indicate that the Calanus inhabiting these waters is part of one vast, continuous community, whose southern frontier is not a straight parallel of latitude but a scalloped border which changes with the seasons; but it is none the less a definite boundary because the species holds together in virtue of the cohesion of the individuals. The Calani, with their rich oily bodies, form a floating mass which does not readily mix with the pure Atlantic water; the line of separation of the calaniferous water from the oceanic water is like a line of contact between fluids of different viscosity which have a slight tendency to mix; the degree of viscosity being influenced by the presence of the copepod swarm.

Calanus finmarchicus is both euryhaline and eurythermal, *i.e.* it is independent of ordinary diurnal and seasonal fluctuations of temperature and salinity. This fact is brought out very clearly by the records of *No. 33* station 23, which show a gradation in percentages of this species entirely disconnected with the gradations in temperature and salinity.

TABLE C.—Steam Trawler *No. 33*, station 23, June 25, 1915, between Anticosti and Gaspé; 49° 31′ N., 63° 58′ W.; depth 355 metres.

TEMPERATURES: CENTIGRADE.

Surface	+8·09°	75m	—0·71°
10m	+8·0°	100 "	—0·22°
20 "	+3·42°	125 "	+0·3°
30 "	+2·21°	150 "	+1·3°
40 "	+1·38°	250 "	+3·7°
50 "	+0·43°	350 "	+4·56°
60 "	—0·12°		

PERCENTAGE OF COPEPOD CONTENT IN PLANKTON.

Species.	Surface 5 mins. 10 CC.	Vertical 45—0m. 12 CC.	Closing net 100—60m. 15 CC.	Closing net 340—145m. 90 CC.
Calanus finmarchicus	100	39	33	20
Calanus hyperboreus	.....	44	52	60
Pseudocalanus elongatus	.....	8	6	2
Gaidius tenuispinus	.....	.....	.....	5
Euchæta norvegica	.....	7	8	7
Scolecithrix minor	.....	2	1	0
Metridia longa	.....	.....	.....	6
	100	100	100	100

SALINITIES.

Surface	28·59	75m	32·51
10m	28·93	100 "	32·84
20 "	30·78	150 "	33·48
30 "	31·31	250 "	34·22
50 "	31·97	350 "	34·62

The tables (I-XII) accompanying this report display the distribution of the principal species met with. It is not necessary to continue the tabulation of every station from *Acadia* 57 to 90, and I will therefore deal with this portion of the exploration somewhat more summarily.

TABLE D.—Percentage of *C. finmarchicus* of all ages at *Acadia* stations 57 to 67.

Stations	57	58	59	60	61	62	63	65	66	67
Percentages	3	50	51	90	80	62	45	47	67	28

At stations 68 and 69 the hauls were so scanty as to be negligible, though *C. finmarchicus* from stage III onwards was present at both. At station 74 the subsurface haul was sparse and contained hardly any copepods; twenty-five were picked out, and these included *C. finmarchicus* III (5), IV (3), and ♀ (1). Here we have an example of a tongue of northern calaniferous water of salinity 33 per thousand bearing southwards over Atlantic water of salinity 35.

In the following table E the vertical hauls were made from 180-0 fathoms except at station 76, where the haul was from 150-0 fathoms.

TABLE E.—Copepod content in the vertical net over the Atlantic slope south of Cabot Strait, July 26-27.

Acadia Stations.	70	72	74	75	76	79
C. finmarchicus III–IV		7			3	30
" V–VI.	2	19		3	27	50
C. hyperboreus III–V	3	5			10	×
C. gracilis				2		
C. tenuicornis			×			
Eucalanus elongatus				2		
Rhincalanus nasutus			×	1		
Clausocalanus arcuicornis		1				
Pseudocalanus elongatus		1			2	
Aetideus armatus			4	7		×
Gaidius tenuispinus				10	5	
Undeuchaeta major			2		×	
" minor			2	2	×	
Euchirella rostrata	6	1	5	3	5	×
" pulchra			×			
Euchaeta acuta			×	1		
" tonsa			×			
" norvegica	13	14	24	21	16	7
Scolecithrix minor		25	4		6	
" ovata			9	5	5	
" bradyi				1		
" danae			×			
" cuneifrons			×	1		
" echinata				1		
Centropages bradyi				1		
Temora longicornis						×
Metridia longa	75	15		2	10	12
" lucens		10	7	10	5	1
Pleuromamma abdominalis			×	4		
" robusta			8	8	5	
" xiphias			×	2		
" borealis		2	35	12		
Heterorhabdus longicornis			×	×		
" norvegicus	1		×	1	1	
Candacia armata				×		
	100	100	100	100	100	100

Acadia station 80, July 27, depth 168 metres, at the eastern end of St. Pierre bank, is of interest as lying close to station 24 of June 2 (see table X). On the earlier date there was a great paucity of copepods but stages II to V of *C. finmarchicus* were observed. At the end of July the same early stages were present and, in addition, the blue copepod, *Anomalocera patersoni*, had put in its summer appearance at the surface.

TABLE F.—Percentage of Copepod content in surface and vertical hauls at *Acadia* station 80, July 27, 4 p.m.

Species.	Surface.	Vertical: 145–0 metres.
C. finmarchicus II	....	×
" III	3	15
" IV	10	25
" V	13	14
" ♀	4	3
Pseudocalanus elongatus	2	15
Centropages hamatus	44	25
Temora longicornis	22	3
Anomalocera patersoni	2	0
	100	100

The next important station is *Acadia* 83, 20 miles south of St. Pierre island. This station, in its depth (172 metres) and proximity to the south coast of Newfoundland resembles *Princess station* 41, which was similarly situated with reference to the north shore of the gulf of St. Lawrence (see table VI). The plankton sample in the vertical haul (*Acadia* 83) consisted of about 85 c.c. of material, but this was highly gelatinous and there were only some 1,500 copepods altogether. In the surface haul (15 minutes) the net was weighted so as to sink it to 5 to 10 fathoms; the amount taken was about 350 c.c., with excessive numbers of Obelia medusæ and young schizopods, and a moderate infiltration of copepods. The plurality of *C. finmarchicus* in this tow (65 per cent) corresponds to its normal midnight plurimum at the same depth, according to Esterly's computations. The agreement is not always so close. At station 86, July 28, 11.10 a.m., the subsurface haul yielded 100 per cent of C. *finmarchicus*, of which 72 per cent belonged to stage V; at this station the temperature fell rapidly from 13·8° C. at the surface to 2·6° at 50 metres, and still further to -0·4° at 75 metres. Perhaps this minimum temperature, in conjunction with the currents, acted temporarily as a false bottom, obstructing the normal daylight descent to the deeper strata. The effect of currents upon the vertical migrations of *Calanus* have been little investigated. The area within which Esterly's collections were made was expressly chosen on account of its freedom from tidal currents and storms.

TABLE G.—*Acadia* 83, July 28, midnight (12.50 a.m.)

Species.	Surface.	Vertical: 160–0 metres.
C. finmarchicus III	2	16
" IV	27	34
" V	35	20
" ♀	1	3
Pseudocalanus elongatus	....	×
Centropages hamatus	25	20
Temora longicornis	10	6
Anomalocera patersoni	....	1
	100	100

Stations 85 to 87 cross the Laurentian Channel and may be compared with *Princess* stations 45 to 47 (table VII) and *Acadia* stations 25 and 26 and 34 and 35 (table X).

It will be seen that the comparison of the vertical hauls is chiefly demonstrative of the relative constancy in the character of the Calanoid fauna in the Laurentian Channel from June to August.

In order to obtain full value from these tables it is necessary to distinguish between what may be called *eurytropic species* which are generally distributed throughout the area covered by the several cruises, and *stenotropic species* whose distribution is seemingly limited within a narrower range by physical factors of temperature, salinity, and depth. Such eurytropic species are *Calanus finmarchicus, Pseudocalanus elongatus, Euchaeta norvegica,* and *Metridia longa.* In consequence of their ready toleration of slight changes in the temperature and saltness of the water these species are not reliable indicators as regards the interaction of currents and the stratification of the water. On the other hand the stenotropic species such as *Calanus hyperboreus, Euchirella rostrata, Scolecithrix minor, Metridia lucens,* and *Heterorhabdus norvegicus,* are especially valuable as indicators. Thus the subjoined table shows that a greater number of these stenotropic species occurs on the eastern side of Cabot strait in the boreal oceanic water which is in the track of the inflowing Cape Ray current, than on the western side in the line of the Cape Breton current which conveys water out of the gulf of St. Lawrence. This agrees with the behaviour, in this region, of certain species of *Sagitta,* as I am informed by Dr. A. G. Huntsman, who has made a most intensive study of the distribution of the Chaetognaths and with whom I have discussed the bearing of some of the data presented in this report concerning the Copepods.

TABLE H.—Vertical hauls in *Acadia* stations 85 to 87, July 28, 1915. Across Laurentian Channel.

Species.	270-0 metres. 85	270-0 metres. 86	290-0 metres 87
Calanus finmarchicus III	1	×	3
" " IV	3	10	10
" " V	25	34	28
" " ♀	15	10	8
" " ♂	2	10	1
C. hyperboreus III	.....	×	×
" IV	3	2	1
" V	2	×	×
" ♀	.....	×	×
Pseudocalanus elongatus	2	2	1
Aetideus armatus	×	×	×
Gaidius tenuispinus	.....	.....	×
Euchirella rostrata	5	×	×
Euchaeta norvegica	16	22	26
Scolecithrix minor	5	2	1
" ovata	1	.....	×
Centropages hamatus	.....	.....	×
Metridia longa	15	5	20
" lucens	5	3	1
Heterorhabdus norvegicus	×	×	.....
	100	100	100

Acadia stations 88 and 89, on Misaine bank, both yielded Euthemisto plankton, including an abundance of *C. finmarchicus* from stage III to spawning females, with an excess of stage IV in all the hauls. On this bank at the beginning of June we encountered an Aglantha plankton, whereas at the end of July there were no medusæ here. As regards the Calanus, the chief change to be noticed was an increase in the number of adult females, 26 per cent in each of the surface hauls at stations 88 and 89. The latter station may be compared with station 79. Finally, at station 91 in the Gut of Canso there was an Evadne plankton with a copepod admixture consisting of

51 per cent *Tortanus*, 25 per cent *Temora*, 15 per cent *Pseudocalanus*, and 9 per cent *Centropages*. The temperature here fell from 12° C. at the surface to 11·45° C. at 45 metres and the salinity was 29·14 per thousand at 20 metres.

TABLE J.—Data for *Acadia* station 89, Misaine Bank, 132 metres, July 28, 1915. 8.35 p.m.

Species.	Surface.	30–0 f.	65–0 f.
C. finmarchicus III	6	1	3
" IV	26	44	34
" V	17	18	16
" ♀	26	10	6
" ♂	2	.....	×
C. hyperboreus III	.....	3	4
" IV	8	15	20
" V	.....	×	1
" ♀	.....	.....	1
Pseudocalanus elongatus	1	4	12
Euchæta norvegica	5	.....	×
Centropages hamatus	5	5	2
Metridia longa	4	×	1
Anomalocera patersoni	×	.....	
Tortanus discaudatus	×	×	
	100	100	100

In September, 1915, Dr. A. G. Huntsman made a short cruise in the Bay of Fundy in the ss. *Prince*, belonging to the Biological Station at St. Andrews. The data for the Copepods at the four stations are given in table XII. For the first time in the course of these investigations we meet with the species *Centropages typicus* which occurs regularly in the gulf of Maine and far to the southward of cape Cod, even reaching the latitude of cape Charles (Bigelow, 1915, p. 293, and fig. 70, p. 294).

At *Prince* station 1, Dr. Huntsman observed a great stirring up of the water from the bottom to the surface in consequence of the eddies caused by the tidal currents surrounding the points of land. The presence *en masse* of *C. finmarchicus* at the surface between 3 and 4 p.m. under a bright sun is unusual, and perhaps the deep-seated turbulence of the water, with the resulting lack of stratification, was responsible for it. It would be worth while to repeat the station, taking samples at intervals through the twenty-four hours, in order to ascertain whether the diurnal migration of Calanus is altogether inhibited. The effect of stratification of the water, so far as temperature is concerned, is seen in an experiment by Dr. G. H. Parker (1902). Female *Labidocera* are negatively geotropic, and remain at the top at all temperatures between 10° and 26° C. If the temperature is raised to 30° C. they become positively geotropic and swim to the bottom. The lower half of a large glass tube was filled with sea-water at 24° C.; into the upper half sea-water at 30° C. was poured gently. A female *Labidocera*, introduced at the top swam rapidly downward, but stopped at the plane of separation for the two temperatures.

Besides the diurnal and seasonal migrations of *Calanus* to which reference has been made, there is another kind of translation which has been called ontogenetic migration by Dr. Giesbrecht. Some pelagic copepods, as *Clausocalanus, Pseudocalanus, Euchæta, Eurytemora*, carry their eggs in an ovisac attached to the genital segment, but most species discharge their eggs directly into the sea. These eggs, according to Giesbrecht's observations, have a somewhat higher specific gravity than the water and consequently sink slowly; whilst they are sinking they accomplish their embryonic development. As soon as the Nauplius larva hatches out of the egg, it ascends towards the surface and towards the light, all copepod Nauplii being positively heliotropic.

The development of *Calanus* from the egg upwards was followed by C. Grobben in 1881, whose memoir I have not had for reference during the preparation of this report. The larval and copepodid stages have recently been described and figured by Marie C. Lebour (1916). All the larval stages are so small that they pass through the fine meshes of the silken tow-net, and this commonly happens with the first two copepodid stages as well. In order to obtain the earliest stages they must either be reared under laboratory conditions or the finest procurable silk bolting cloth must be used for making the tow-nets.

It is not known exactly when the ontogenetic migrations end and the diurnal migrations begin. Esterly (1911) confines his enumerations to stages V and VI which he considered together, rejecting the younger forms. Making allowance for the fact that stage I rarely comes under observation, we may still unite stages I, II, III, and IV as a superstage under the term *juniores* as employed by Gran, in order to compare it with the superstage of which stage V is the adolescent and stage VI the adult form. By grouping certain of the data contained in the tables in the manner indicated, a contrast appears between the distribution of the juniors and that of the two final stages, the former being more bound up with the surface layers than the latter. For example, at *No. 33* station 17 there was a copious and typical microcalanoid plankton of stages II and III, together with *Pseudocalanus* at the surface (see table VIII). The contrast which is brought out in the subjoined table K is a partial illustration of the ontogenetic migrations of *Calanus finmarchicus*. If the closing net could have been used more frequently, and if actual numbers were given instead of percentages, the differences in the behaviour of the two superstages would have been rendered much more manifest. Of course these ratios have no claim to exactness because so many interacting factors disturb the simple relations, but they may serve to bring the problem into relief.

There is reason to suppose that if stages V and VI were examined separately they might also exhibit differential behaviour. Indications of inverse behaviour of stage V and VI (♀) are to be found amidst the data recorded in the tables. At *Acadia* station 39 the surface ratio of V to VI was as 10:40; in the vertical haul from 25-0 metres as 15:24; in the vertical haul from 100-0 metres as 26:19. Again at *No. 33* station 23, the surface ratio of V to VI was as 0:90; in the vertical haul from 45-0 metres as 2:20; in the closing net from 100-60 metres as 5:23; in the closing net from 340-145 metres as 15:2.

TABLE K.—Ratio of juniors (II-IV) to adults (V-VI) of *C. finmarchicus* in surface and vertical hauls. *Ac.* = *Acadia;* Ps. = *Princess;* P. = *Prince;* m = metres; f = fathoms; jun = juniores; ad = adolescents and adults.

Station.	Depth.	Time.	Range of vertical haul.	Ratio of jun. to ad. in vertical haul.	Ratio of jun. to ad. at surface.
Ac. 5	72m	1 a.m.	60–0m	44 : 38	80 : 20
Ac. 14	2000m	12.50 p.m.	200–0m	20 : 56	nil
Ac. 16	"	1.45 a.m.	"	0 : 13	12 : 70
Ac. 26	500m	10 p.m.	100–0m	9 : 53	27 : 47
Ac. 28	"	6 a.m.	100–25m	8 : 41	51 : 36
Ac. 49	126m	3.40 p.m.	125–0m	42 : 46	80 : 7
Ac. 50	151m	7.30 p.m.	145–0m	21 : 47	40 : 40
Ac. 52	99m	1.45 a.m.	90–0m	35 : 51	60 : 32
Ps. 16	100f	1.15 p.m.	100–0m	24 : 40	66 : 12
Ps. 20	"	6 a.m.	"	23 : 37	81 : 9
Ps. 21	"	9.45 a.m.	"	26 : 43	89 : 2
Ps. 39	284m	7.30 p.m.	130–0m	60 : 15	50 : 5
Ps. 46	400m	6 a.m.	130–0m	17 : 74	47 : 53
P. 1	18f	3.45 p.m.	18–0f	6 : 68	18 : 72
P. 2	60f	4.30 p.m.	55–0f	3 : 70	25 : 17

PART II.

NOTES ON SPECIES.

1. *Calanus finmarchicus.*—There is a wide range of variation in the size of the individuals during the several copepodid stages and this is often to be observed at one and the same station. It is assumed that the transition from one stage to another is effected by a single exuviation. In one case I observed the new cuticle of stage V forming beneath the old cuticle of stage IV, as shown most clearly by the coxal denticulation of the fifth foot. The denticulation on the inner margin of the basal joint of the fifth foot occupies the whole of that margin in both stages V and VI; at stage IV only the middle third of the coxal joint shows the marginal denticulation (text fig. I). It is to be noted that the outer denticulation shown in the figure is much more restricted in certain individuals.

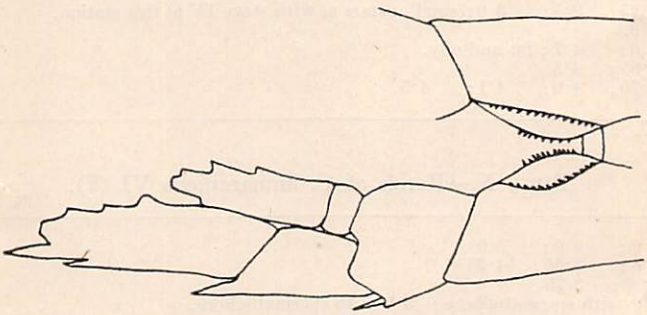

Fig. 1.—*C. finmarchicus* stage IV, length 3·2 mm.; fifth feet showing transition to succeeding stage. *Acadia* station 9.

By employing biometrical methods, Gran (1902) found that within the limits of the Norwegian North Sea, the individuals averaged larger in the north than in the south. For example at stage III (synonymous with Gran's fourth stage) the maximum length of the forebody in individuals captured in latitude 60° 43′ N. was 1·25 mm., while in those taken in latitude 67° 41′ N. the maximum length of forebody was 1·48 mm. Gran also found in general that the stages are smaller in summer than in spring. It is doubtful whether these biometrical results are applicable to other regions. To render the history complete, it would be necessary to take stock of the frequency of exuviations, and up to the present this has not been found practicable.

The following tables give a few examples of range of size at stages IV, V, and VI. The measurements were taken from the front of the head to the end of the caudal fork.

TABLE L.—Range of C. finmarchicus IV.

Station.	(measurements in millimetres.)
Ac. 9.....	2·2; 3·2
Ac. 28.....	2·0; 2·9
Ac. 79.....	1·9 to 2·0; small instars from 30-0 fathoms. In the haul from 180-0 fathoms some of 2·35 mm. were taken.
Ac. 88	2·75; 3·0
Ac. 89.....	3·0; large instars from 30-0 fathoms (compare Ac. 79).

TABLE M.—Range of C. finmarchicus V.

Ac. 5	2·9; 3·0; 3·5
Ac. 48.....	2·65; 4·5
Ac. 79 ...	2·25; 2·5; 3·0; small instars as with stage IV at this station.
Ac. 80.....	4·9.
Ac. 85	3·6; 4·7; fat and oily.
Ac. 86.....	2·65; 4·5
Ac. 88.....	2·75; 4·0; 4·1; 4·5

TABLE N.—Range of C. finmarchicus VI (♀).

Ac. 4.....	3·0; 4·0; 5·0
Ac. 5.....	3·5; 3·65; 4·25
Ac. 8	3·35; 3·75
Ac. 79.....	2·9 with spermatophore; 3·0 with spermatophore.
	3·2 with spermatophore; 4·5
Ac. 85.....	5·0 with spermatophore and turgid with pale pink oil.
Ac. 86 ...	3·65; 5·0
Ac. 88	3·5
Ac. 89.	5·2; 5·5 with spermatophore.

TABLE O.—Range of C. finmarchicus VI (♂).

Ac. 86... .	3 05; 5·0

The greatest contrast in average size is exhibited between stations 79 and 89. Table P accordingly gives the hydrographical data for these stations as worked out by Mr. Paul Bjerkan.

TABLE P.—Hydrographical data for *Acadia* stations 79 and 89.

Metres.	44° 47′ N., 55° 13′ W. Station 79.		45° 16′ N., 59° 4′ W. Station 89.	
	Salinity.	Temperature.	Salinity.	Temperature.
0	32·42	13·05	30·52	13·95
10	32·53	11·1		
25	32·85	9·5	30·90	9·1
50	33·06	5·5	31·92	0·75
75	33·33	2·5	32·13	0·15
100	33·97	4·9	32.13	0·15
125			32·24	0·05
150	34·40	5·9		
200	34·60	6·2		
300	34·61	4·65		
400	34·72	4·15		

2. *Calanus hyperboreus.* This Arctic species is nearly as widely distributed in our area as the preceding, but it is bound up with the deeper layers of water and in that sense it is stenotropic, rarely appearing in surface hauls in these latitudes. Moreover it does not range so far south as *C. finmarchicus.* The *Grampus* found that, like *Euchaeta norvegica* and *Metridia longa,* it was limited to the waters north of cape Cod and was taken only at four out of twenty one stations in the gulf of Maine. At *Grampus* station 10100 between cape Sable and Penobscot bay, opposite the mouth of the Bay of Fundy, the vertical net from 90-0 fathoms contained 270 individuals of *C. hyperboreus* to 5400 *C. finmarchicus,* this being its plurimum for the gulf of Maine (Bigelow, 1915, p. 293).

According to Damas and Koefoed (1905) *C. hyperboreus* is the commonest form at the surface in the Greenland sea. In Canadian waters there does not seem to be any regularity in its occurrence at or near the surface and each case would probably need to be accounted for by reference to local and temporary conditions. Its presence to the extent of 5 per cent in the deep surface haul with weighted net at *Acadia* station 85 and not at stations 86 and 87 is perhaps significant in view of what has been stated regarding this station (see above, table H).

No male was observed in any of the hauls. Sometimes there may be a little doubt regarding the identification of this species at stage IV with the three-jointed urosome. The postero-lateral angles of the forebody are not always so distinctly pointed as is usual. In such cases the doubt is at once removed by the examination of the fifth legs which although possessing coxal denticulations in the subsequent stages, are, unlike *C. finmarchicus,* devoid of them at stage IV in *C. hyperboreus.*

3. *Calanus vulgaris.*—Other species of Calanus were met with at stations in or near the Gulf Stream. Of these the most remarkable was *C. vulgaris* which is not mentioned in "Nordisches Plankton" (v. Breemen 1908). The female of this species has the postero-lateral angles of the forebody produced on each side as a ventrally

curved hook; in the male these edges are rounded, and the fifth feet have a peculiar vermiform process on the left side which distinguishes it from all others. It occurred at *Acadia* station 44 in the vertical haul, males and females, some of the latter having a spermatophore attached to the urosome or hind-body.

C. tenuicornis was recorded at *Acadia* stations 17, 74, and 75; *C. gracilis* at 42, 44, and 75; *C. minor* at 44 (18 per cent at the surface), 56 (one male in closing net from 210-140 fathoms), and 75 (males and females at the surface). *C. minor* is another species not mentioned in "Nordisches Plankton"; Wheeler observed numerous females taken in Gulf Stream tow, July 25, 1899, the locality being 60 to 80 miles south of Martha's Vineyard.

4. *Eucalanus* and *Rhincalanus.*—All the species of these two genera which are included in "Nordisches Plankton" were encountered in stations tangential to the Gulf Stream; many of the individuals were immature, especially was this the case with *Rhincalanus.* When attempting to differentiate the young stages of *Rh. cornutus* and *nasutus,* the conspicuous feature of the forwardly produced head with its rostral filaments is not an unfailing guide. Figs. 2 and 3 show the appearance of the fifth feet in young females of *cornutus* and *nasutus;* figs. 4 and 5 show the fifth feet in young males of *cornutus* of two sizes.

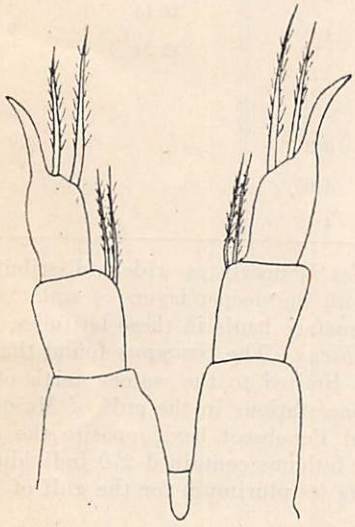

Fig. 2.—*Rhincalanus cornutus* juv. ♀. Length 3 mm. Fifth feet. *Acadia* station 44. 150-0 fathoms.

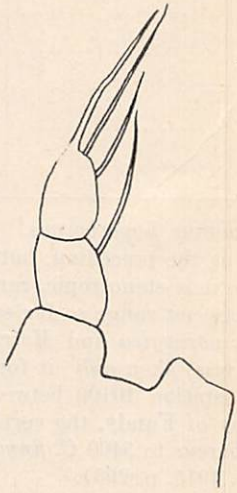

Fig. 3.—*Rhincalanus nasutus* juv. ♀ 3 mm. Fifth feet, one shown. Same station.

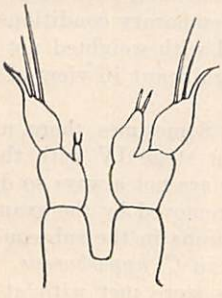

Fig 4.—*Rhincalanus cornutus* juv. ♂. Fifth feet, hinder surface.

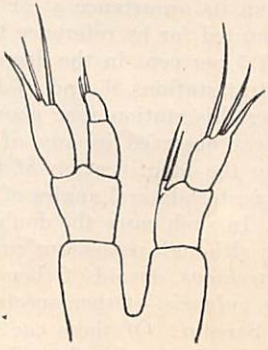

Fig. 5.—*Rhincalanus cornutus* juv. ♂. Fifth feet, front surface of older stage.

5. *Clausocalanus arcuicornis.*—Previously recorded by Wheeler from the Gulf Stream. In the deep surface tow of *Acadia* station 74 there were very few copepods; out of a total of 25 counted, 11 were of this species, the others being *C. finmarchicus* III (5), IV (3), ♀ (1); *C. minor* (2); *Scolecithrix minor* (1), *danæ* (1); *Acartia* sp. (1).

6. *Pseudocalanus elongatus.*—The abundance of this small but rich and oily species in the gulf of St. Lawrence is paralled by its frequency in the gulf of Maine. In the intervening stretch of water between the entrance to Cabot strait and to the bay of Fundy it does not occur in such great numbers. In the May plankton of the gulf of St. Lawrence between Prince Edward island and the Magdalen islands, it constituted on the average between eighty and ninety per cent of the copepod content. At several other stations inside the gulf it reached to 20 per cent and upwards. In none of the *Acadia* stations outside the gulf did it attain as much as 20 per cent, the nearest to this quantity being 17 per cent at station 67; 15 per cent at 80 and 90; 14 per cent at 36. In all the females which have come under my observation in the preserved material the ovisac was ruptured and the eggs appeared to be attached singly to the genital segment, sometimes one at a time, frequently two, rarely three. Often the shreds of the stalks of attachment are left behind after the egg has been liberated or torn away. When two eggs are present they may be seen to be attached separately side by side. Sometimes there will be one egg and the shrivelled stalk of another beside it. Spermatophores are sometimes applied to one and the same female in great numbers. In the example represented in fig. 6, I counted as many as twenty-four spermatophores.

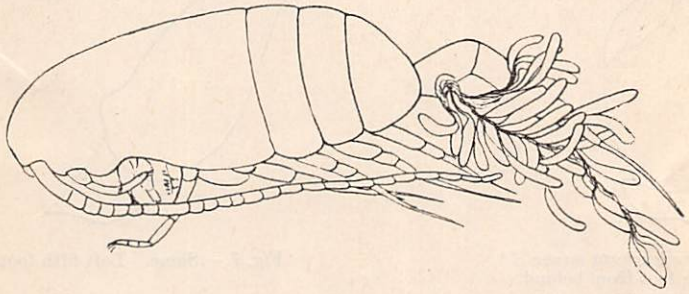

Fig. 6.—*Pseudocalanus elongatus* ♀, beset with spermatophores, "Princess" station 30, August 4th. 30-0 metres.

7. *Ætideus armatus* and *Gaidius tenuispinus.*—Neither of these species has been recorded previously from eastern American waters, that is to say not by Wheeler nor by Bigelow. They occurred together in *Acadia* station 75 in the vertical haul (180-0 fathoms or 325-0 metres) and again at station 87 (290-0 metres). Another noteworthy record for *Gaidius* was at *No. 33* station 23 in the closing net from 340-145 metres. Besides this it was present in the vertical haul at *Acadia* station 46 (270-0 metres).

Ætideus was not found at any station in the gulf of St. Lawrence. In addition to the two *Acadia* stations mentioned above it occured also at stations 17 (200-0 m); 25 (120-0 m.); 44 (270-0 m.); 74 (325-0 m.); 79 (325-0 m.); 85 (270-0 m.); 86 (290-0 m.).

8. *Undeuchæta major* and *minor.*—These were not found by Wheeler but they are mentioned by Bigelow (1915, p. 287). They are Gulf Stream species and *minor* is the more frequent. They occurred together at *Acadia* stations 46, 74, and 76. They are found also in the San Diego region whence the male of *U. major* has been described by C. O. Esterly (1905). The male of *U. minor* has remained hitherto unknown. Several examples were taken in the *Acadia* hauls. The structure of the fifth feet of

the male of *U. minor* differs from that of *U. major* in the absence of the forceps mechanism described by Esterly on the left foot and in some other respects. The chief differences are displayed in table Q, supplemented by text-fig. 7 and 8. The posterolateral angles of the forebody are rounded; rostrum strongly deflexed; anterior antennæ exceed length of forebody.

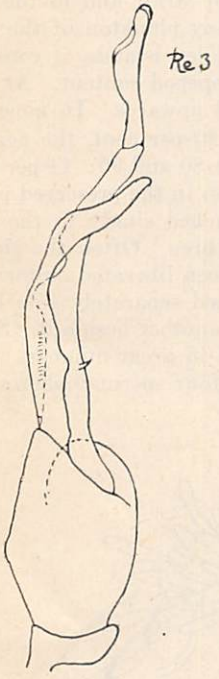

Fig. 8.—*Undeuchæta minor* ♂
Right fifth foot from behind.
Re=outer branch.

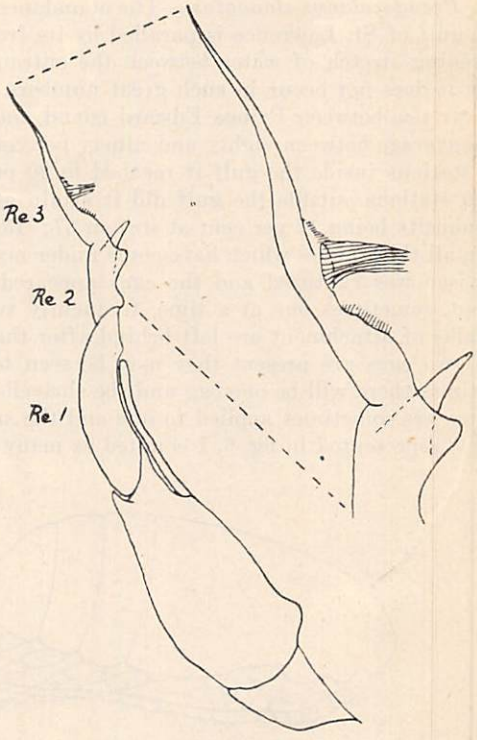

Fig. 7.—.Same. Left fifth foot.

TABLE Q.—Comparison of fifth feet (p5) of *Undeuchaeta major and minor* ♂.

Features.	*Undeuchaeta major* ♂ (after Esterly.)	*Undeuchaeta minor* ♂ ("Acadia" material.)
Length	6·5mm	3·5 mm.
Right p5	Biramous	Biramous (fig. 8)
Outer branch (Re)	Terminal joint produced into a long stylet.	Terminal joint with spoon-shaped extremity.
Inner branch (Ri)	Simple	Simple.
Left p5	Biramous	Biramous (fig 7).
Re	Terminal joint ending in a short style which carries a pencil of long hairs near its centre. Second joint bearing a toothed process "which flares distally"; "at the base of this and on the second joint is articulated a process, which together with the terminal joint of the ramus and the toothed process forms a forceps."	Terminal joint ending in a stylet with a pencil of long hairs together with some denticulations near its centre, and a stout thorn at its base. Second and third joints incompletely separated.
Re	Vestigial	Vestigial

9. *Euchirella rostrata.*—Several species of *Euchirella* occurred in the vicinity of the Gulf Stream but the most widely distributed was this one. It has a distinctive appearance with its portly crimson-tinted forebody and short urosome. It was present in varying quantity at twenty-four of the *Acadia* stations but never in the surface hauls. At stations 85-87 which traversed the Laurentian channel between St. Pierre and Misaine banks, its mode of occurrence is significant in view of what has been said before. At each of these stations a vertical haul was taken from 30 fathoms to the surface, and another from 150 or 160 fathoms to the surface. At station 85, *Euchirella rostrata* occurred in both of the vertical hauls, two per cent from 30-0 fathoms, five per cent from 150-0 fathoms; at stations 86 and 87 it was present only in the deeper hauls. Its distribution within our area is shown on may (fig. 9). At station 54, where it appeasr with the high plurality of 43 per cent, it should be mentioned that the plankton here was very scanty, the vertical haul (150-0 fathoms) including only about 140 copepods in all. Other species of *Euchirella* were taken as indicated on table XI.

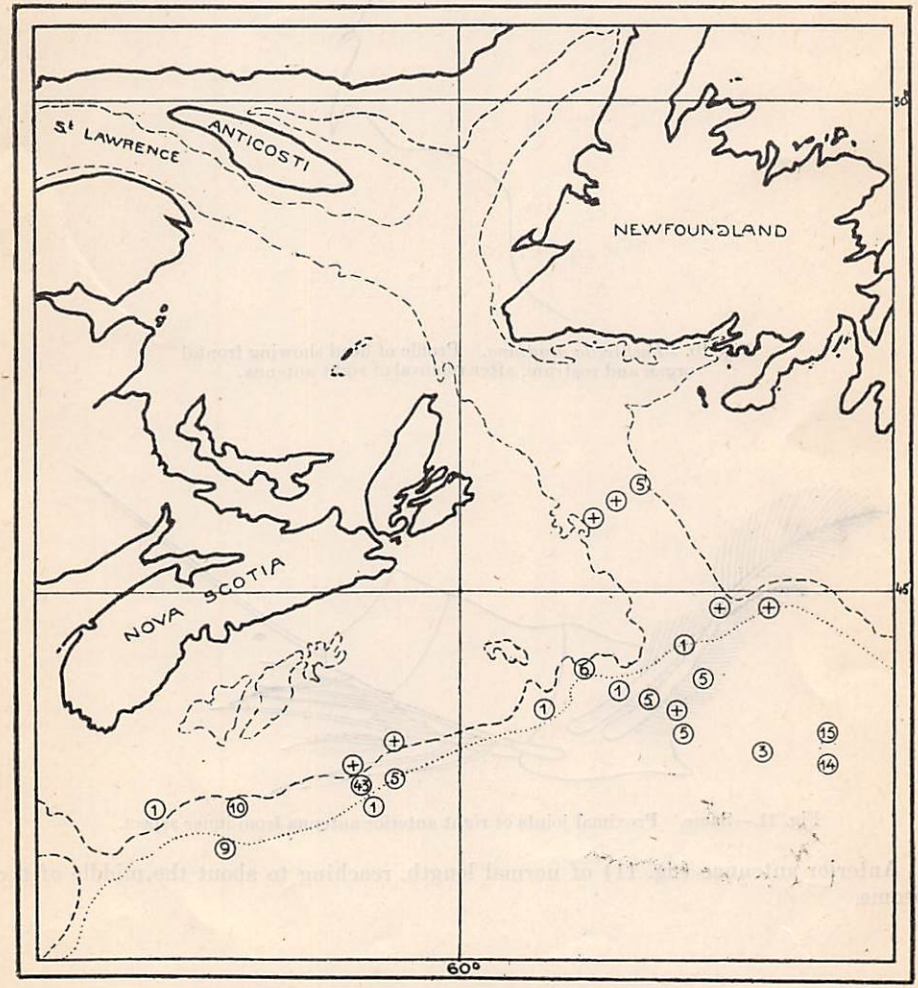

Fig. 9.—Distribution of *Euchirella rostrata.* The numbers indicate percentage of copepod content.

10. *Euchirella acadiana* n. sp.—A few examples were taken of the female only of this species which I have not been able to fit in with any published description. The occurrence was at *Acadia* stations 41 (200-0 m., one); 44 (270-0 m., two); 56 (210-140 fathoms, two). In the following diagnosis Giesbrecht's notation is employed: Length 6.25 mm. (5 + 1.25); rostrum deflexed, pointed (fig. 10); genital segment symmetrical except for a low oblique brown chitinous ridge on the left side seen from above near the hinder margin; postero-lateral angles of forebody broadly rounded.

Fig. 10.—*Euchirella acadiana*. Profile of head showing frontal organ and rostrum, after removal of right antenna.

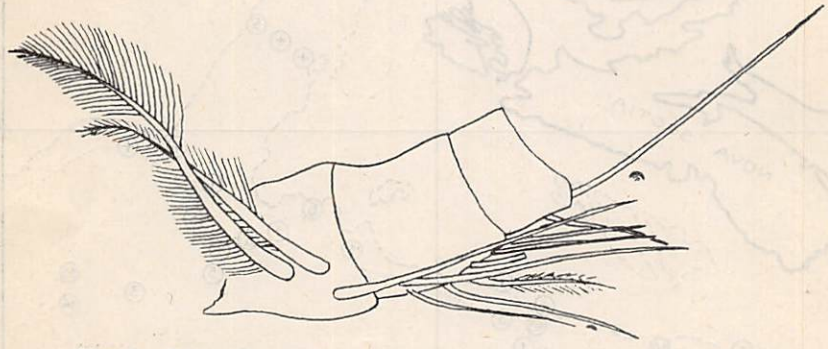

Fig. 11.—Same. Proximal joints of right anterior antenna from inner aspect.

Anterior antennae (fig. 11) of normal length, reaching to about the middle of the urosome.

Posterior antennæ (fig. 12) with three very long feathery setæ at the end of Re 7; B 1 with plumose Si (as in *messinensis*); B 2 with one Si (as in *messinensis*); Re 1 and 2 incompletely divided, with a crest and spur at inner distal margin of Re 1 (as in *curticauda*); Ri about four-fifths the length of Re 1 and 2; Ri 2 bearing 15 setæ, of which there are six in a row on Le, 7 in a row on Li, the innermost being the shortest, and in addition a very short Sp on Li near the point where it is continuous with Le, and a somewhat longer Sp on Le.

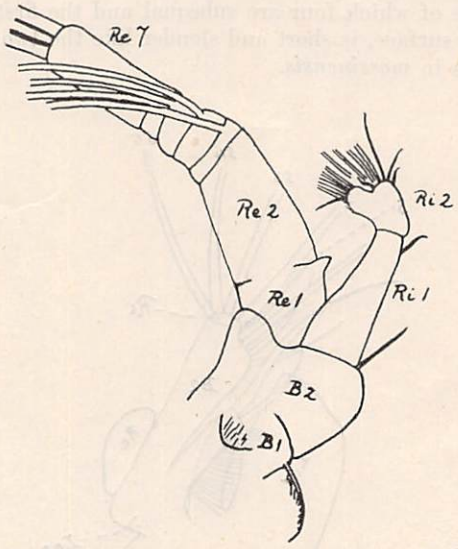

Fig. 12.—Same. Posterior antenna, hinder surface
The two posterior setæ on Ri 2 may be noted

Maxilla (fig. 13): Le 1 with 8 setæ (as in *messinensis*), the fifth seta about three-fourths the length of its neighbours; Le 2 small, without seta (as in *rostrata*); Li 1, hinder surface glabrous (as in *rostrata*), in the typical group 11-14 there are only three setæ (as in *messinensis*); Li 2, with 4 setæ, Sp 1 and 2 equal, long and stout, Sa 1 much shorter, Sa 2 slender but nearly as long as the Sp; Li 3 with fringe of long hairs along the length of its anterior surface, at its end which is exactly on a level with the end of Li 2 there are only two setæ, a distal long and stout seta and near it a more proximal shorter seta; B 2, setæ as in *rostrata,* surface ciliation as in *messinensis;* Ri with 5 setæ of which four are subequal and the first, situated at the inner angle on the posterior surface, is short and slender like the two proximal setæ of B 2; Re with eleven setæ as in *messinensis.*

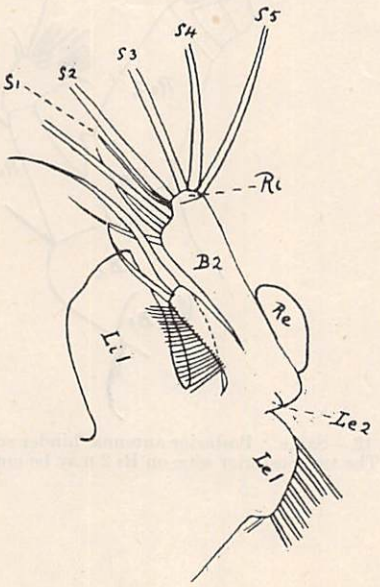

Fig. 13. Same. Maxilla, anterior surface. Setæ omitted from Li 1 and Re. Li 2 is partly concealed by Li 3 whose fringe of hairs passes over it. S 1 to S 5 are the five setæ of Ri; S 1 is seen with difficulty from this side, but is very distinct from the hinder aspect.

Anterior maxillipede (fig. 14): Distinctive are the close-set fringes of spine-like hairs on the posterior surface of L 1 to L 4; otherwise as in *rostrata;* the deep outer emargination of B 1, a generic character, forms a right angle with the succeeding portion of the margin which is nearly straight.

Fig. 14. Same. Anterior maxillipede hinder surface, setæ omitted.

Posterior maxillipede (fig. 15): the single seta of the first or proximal group (or "lobe") on B 1 is placed as in Giesbrecht's figure of *Chiridius poppei;* L 2 with two setæ, one long, one short; L 3 with three setæ (two long, one short); L 4 with three setæ, two long, one short; a short longitudinal series of points on anterior surface of B 2 near its proximal end; the first seta of B 2 lies very slightly distad of the centre of the inner margin.

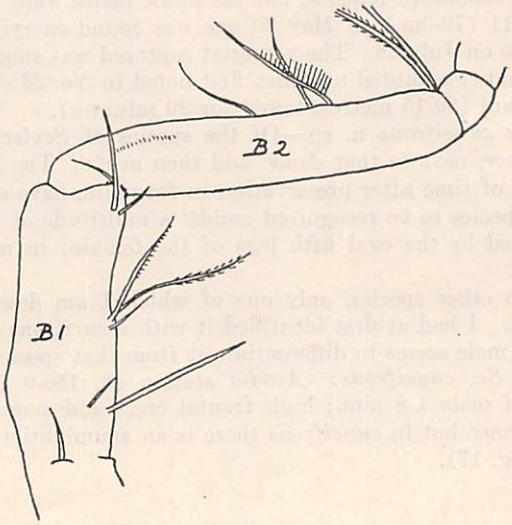

Fig. 15.—Same. Portion of posterior maxillipede.

Fourth legs: basal joints with the characters shown in fig. 16.

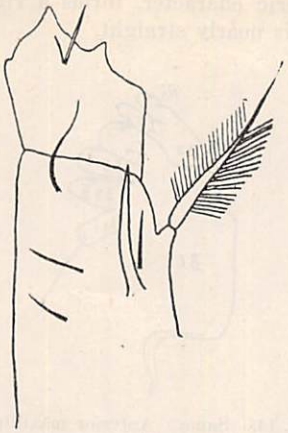

Fig. 16. Same. Basal joints of left fourth leg.

11. *Euchaeta norvegica.*—As mentioned this is a eurytropic species occurring in surface and vertical hauls both inside the Gulf of St. Lawrence and outside. It was found in different stages corresponding to those detailed for *C.finmarchicus* and *hyperboreus.* Ovigerous females with single large ovisac full of blue eggs were found, notably at *Acadia* station 48 on July 23, at *No. 33* station 57 (Bay of Islands) on August 9, and at *Prince* station 3 (Bay of Fundy) on September 15. Immature males were as common as immature females, but the adult males were very rarely captured. At *Acadia* station 11 (70-0m.) on May 30 one was found carrying a spermatophore; another at station 70 on July 26. The youngest captured was stage II with three pairs of swimming legs and two-jointed urosome, first noted in *No. 33* station 26 on June 26 in the subsurface haul (30-15 metres, towed for 20 minutes).

12. *Scolecithrix cuneifrons* n. sp.—Of the species of *Scolecithrix* met with, the commonest was *minor,* next to that *danæ,* and then *ovata.* The appendages of *danæ,* for a certain length of time after preservation in formalin, have a delicate mauve tint which enables the species to be recognized amidst a multitude of other Copepods. *Sc. ovata* is characterized by the oval fifth legs of the female; in many specimens they are not to be found.

There were two other species, only one of which I am describing here since it appears on table XI. I had at first identified it with *securifrons* but the structure of the fifth legs of the male seems to differentiate it from that species.

Description of *Sc. cuneifrons: Acadia* station 46, 150-0 fathoms. Length of female, 4·5 mm.; of male 4·8 mm.; high frontal crest and acuminate postero-lateral angles as in *securifrons,* but in *cuneifrons* there is an acumination in the male as well as in the female (fig. 17).

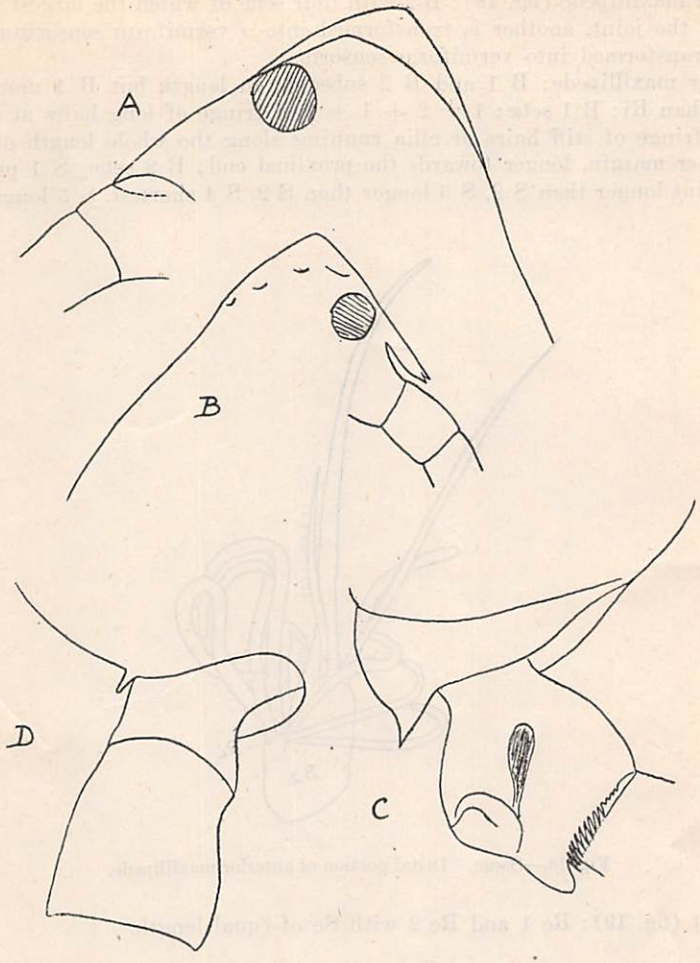

Fig. 17. Scolecithrix cuneifrons.

A. Frontal profile of female of 4·5 mm.
B. Frontal profile of female of 3·6 mm.
C. Postero-lateral angle and genital segment ♀.
D. Postero-lateral acumination of ♂.

Rostrum produced, bluntly bifid at extremity; anterior antennæ as long as body, 23-jointed in ♀, 18-jointed in ♂; mouth-parts not aborted in ♂. Posterior antennæ: Re one and a half times the length of Ri; B 1 with short plumose seta; B 2 with two setæ, one long, one short; Re 1 and 2 distinct, Re 2 twice as long as Re 1, Re 2 seven-eighths the length of Re 7, Re 1 and 2 one and a third times the length of Re 7, Re 2 with one distal slender seta, Re 3, 4, 5, and 6 each with a long plumose seta, Re 7 with a long proximal seta inserted at the proximal fifth of the joint and three long terminal plumose setæ; Ri 1 with slender distal seta which is about twice the length of Ri 2, distal outer convexity of Ri 1 fringed with cilia, Ri 2 with 8 setæ on Li and six on Le, outer convex margin of Le fringed with stiff curved cilia. Maxilla: Li 1 with crowded setæ, thirteen counted, Li 2 with two setæ, Li 3 with three equal setæ; Le 1 with nine setæ; Re with eight setæ; Ri with seven setæ; B 2 with five setæ. In Ri and B 2 the number of setæ given includes in each case one anterior seta.

Anterior maxillipede (fig. 18): B 2 with four setæ of which the largest is not articulated with the joint, another is transformed into a vermiform sensorium; Ri with seven setæ transformed into vermiform sensoria.

Posterior maxillipede: B 1 and B 2 subequal in length but B 1 much broader, B 2 longer than Ri: B 1 setæ: 1 + 2 + 1 + 3, a fringe of long hairs at distal end; B 2 with a fringe of stiff hairs or cilia running along the whole length of the joint near the inner margin, longer towards the proximal end; B 2 setæ: S 1 proximad of middle of joint longer than S 2, S 3 longer than S 2, S 4 shortest, S 5 longest.

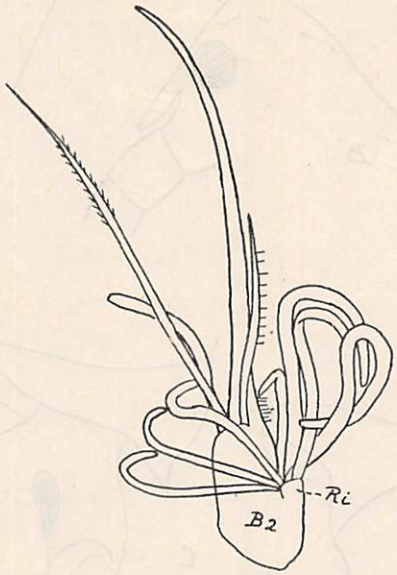

Fig. 18.—Same. Distal portion of anterior maxillipede.

First foot (fig. 19): Re 1 and Re 2 with Se of equal length.

Fig. 19.—Same. First foot anterior surface.

Second foot: B 1 has an acumination on the outer margin like that on the third foot but standing closer into the border, convex inner margin below the Si with long cilia. Ri does not reach distal margin of Re 2; spinules on posterior surface of Ri 2: 2 + 2 + 2, the largest is the outer one of the proximal couple, the smallest is the inner one of the same couple. The spinules on the posterior surface of Re are: on Re 2 a transverse row of seven distal spinules continued proximad on the inner side by three longitudinally placed spinules, the whole forming a continuous arc; spinules on Re 3, two arcuate rows, namely: a distal arc of small unequal spinules, the two lowest of the arch being level with the bases of Se 2 and Si 3; a proximal arc between the bases of Se 1 and Si 2, the three inner spinules much larger than the rest.

Third foot (fig. 20 A and B): the character of B 1 and the spinulation of the rami are shown sufficiently in the figures; several minimal spinules at level of Si 2 on posterior surface of Re 3, otherwise no perceptible spinulation on that joint.

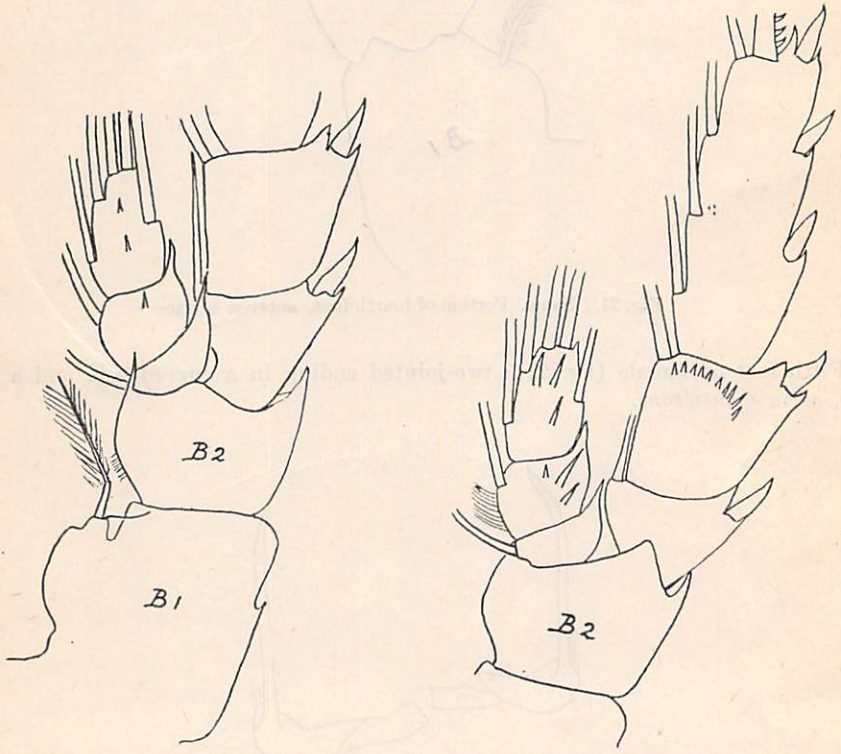

Fig. 20 Same. Third foot.
A. Anterior surface, including B 1. B. Posterior surface, including Re 3.

Fourth foot (fig. 21): B 1 with plumose seta; Ri extends beyond distal margin of Re 2, nearly reaching base of Si 1 of Re 3; Ri 2 two-thirds as long as Ri 3; Re 2 with outer margin ciliate; Re 3 with outer margin, below the proximal Se, ciliate.

Fig. 21. Same. Portion of fourth foot, anterior surface.

Fifth foot of female (fig. 22): two-jointed ending in a curved seta and a small spine, as in *securifrons*.

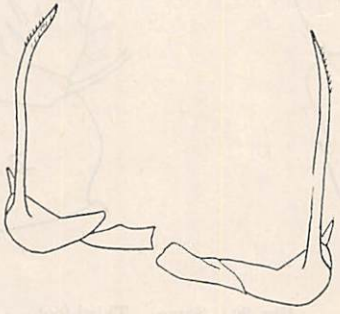

Fig. 22. Same. Fifth pair of appendages of female.

Fifth appendages of male (fig. 23 A and B): Left foot biramous, right foot uniramous with a process on B 2 which might represent a rudimentary endopoditic process as described by Giesbrecht for *Scolecithrix vittata*; left Re and Ri two-jointed.

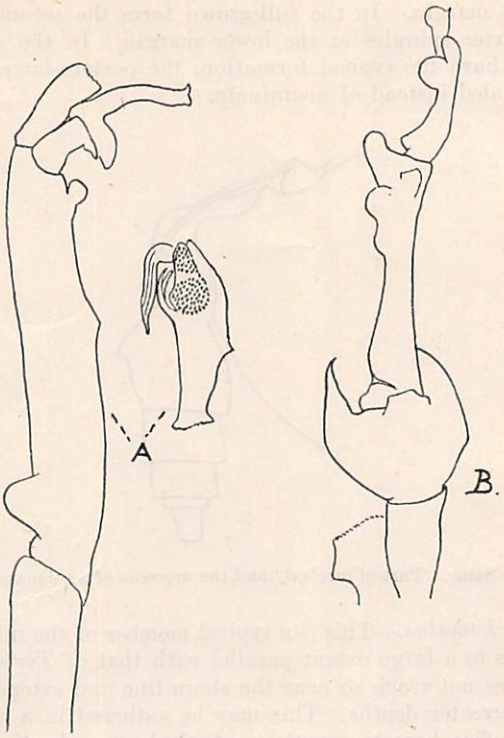

Fig. 23.—Same. Fifth appendages of male
A. Left foot; second joint of Re broke off and drawn separately, showing cushion of points.
B. Right foot.

The submature female of this species, 3.6 mm. in length, with the adult segmentation but not having attained the full size and maturity, differs in several points from the full-grown female. The genital segment (fig. 24) has a proximal protuberance in place of the distal process (compare fig. 17 C) and does not possess the serrations at the posterior lateral margin. In the full-grown form the second abdominal segment has a fringe of shorter spinules at the lower margin. In the submature individual while the fifth feet have the typical formation, the postero-lateral angle of the forebody is bluntly rounded instead of acuminate.

Fig. 24.—Same. Part of forebody and the urosome of a submature female.

13. *Centropages hamatus.*—This is a typical member of the microcalanoid plankton whose distribution is to a large extent parallel with that of *Tortanus discaudatus* but on the average it does not reach so near the shore line and extends further out to sea, that is to say, over greater depths. This may be gathered in a general way from the tables and it will suffice here to mention a typical example of a copious and clean, gray-toned microcalanoid plankton, namely, the Souris Tortanus plankton exemplified in *No. 33* station 7. In addition to the proceeds of this station, Dr. Huntsman on several occasions procured samples from canoes and motor boats, thus establishing the character of the Souris summer copepod plankton. Figure 25 shows the urosome of a submature female with the adult urosome forming within the adolescent cuticle. It was taken at the surface at *Acadia* station 62 on July 25.

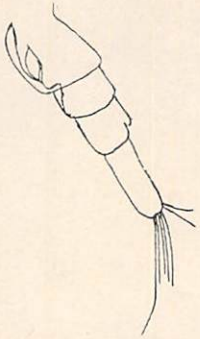

Fig 25.—*Centropages hamatus* Urosome of adolescent female, shortly before an exuviation.

Centropages bradyi Wheeler was taken in *Acadia* stations adjoining the Gulf Stream in the vertical hauls, viz., at 41, 42; in deep surface haul and vertical haul at 75. *C. typicus* was taken by Dr. Huntsman in the Bay of Fundy at *Prince* stations 2, 3 and 4.

14. *Temora stylifera*.—Whereas *Temora longicornis* is as widely distributed as is *Centropages hamatus, Temora stylifera* occurred in some numbers only at *Acadia* station 44. Most of the animals were females in the adolescent stage which differs so remarkably from the adult form that I was for some time in doubt as to their identification. The lateral angles of the head are drawn out into two free processes like those of trilobites (fig. 26). Unfortunately I have not had access to the original description of the species by Claus, but the processes are not mentioned in the works of reference which I have consulted as they do not occur in the full-grown stage. Otherwise the structure of the appendages is typical. An adult male, 1·75 mm. had no prolongations of the lorica.

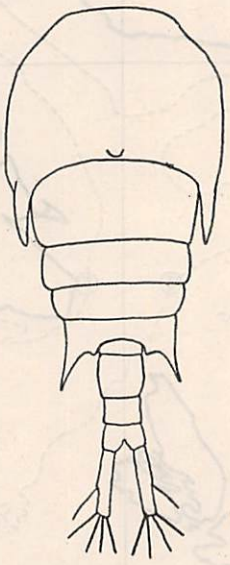

Fig. 26. *Temora stylifera*. Dorsal view of adolescent female to show the lateral processes of the head; anterior antennæ omitted. Length 1·5 mm. Furcal setæ broken.

15. *Metridia longa* and *lucens*.—The mutual relations of these two species in their distribution may be gathered from the tables. The former species ranges far and wide in the Gulf of St. Lawrence having been taken in deep water in the Gaspé channel at *No. 33* station 23. In the Bay of Islands at *No. 33* station 57 a typical *Metridia longa* plankton was obtained. On the other hand *Metridia lucens* does not seem to penetrate so deeply into the gulf of St. Lawrence being only recorded at two stations, namely, at *No. 33* station 69 (3 per cent) and *Princess* station 45 (5 per cent). It was also taken by Dr. Huntsman at *Prince* stations 1, 2, and 3. Its distribution at representative stations is shown on the map (fig. 27). It was generally taken in vertical hauls, rarely at or near the surface. It was taken regularly by the *Grampus* in the gulf of Maine, while *M. longa* only occurred sparsely. Bigelow states that *M. longa* was not found in the gulf of Maine in the 1912 cruise, and its discovery in the 1913 cruise was the first record for American waters.

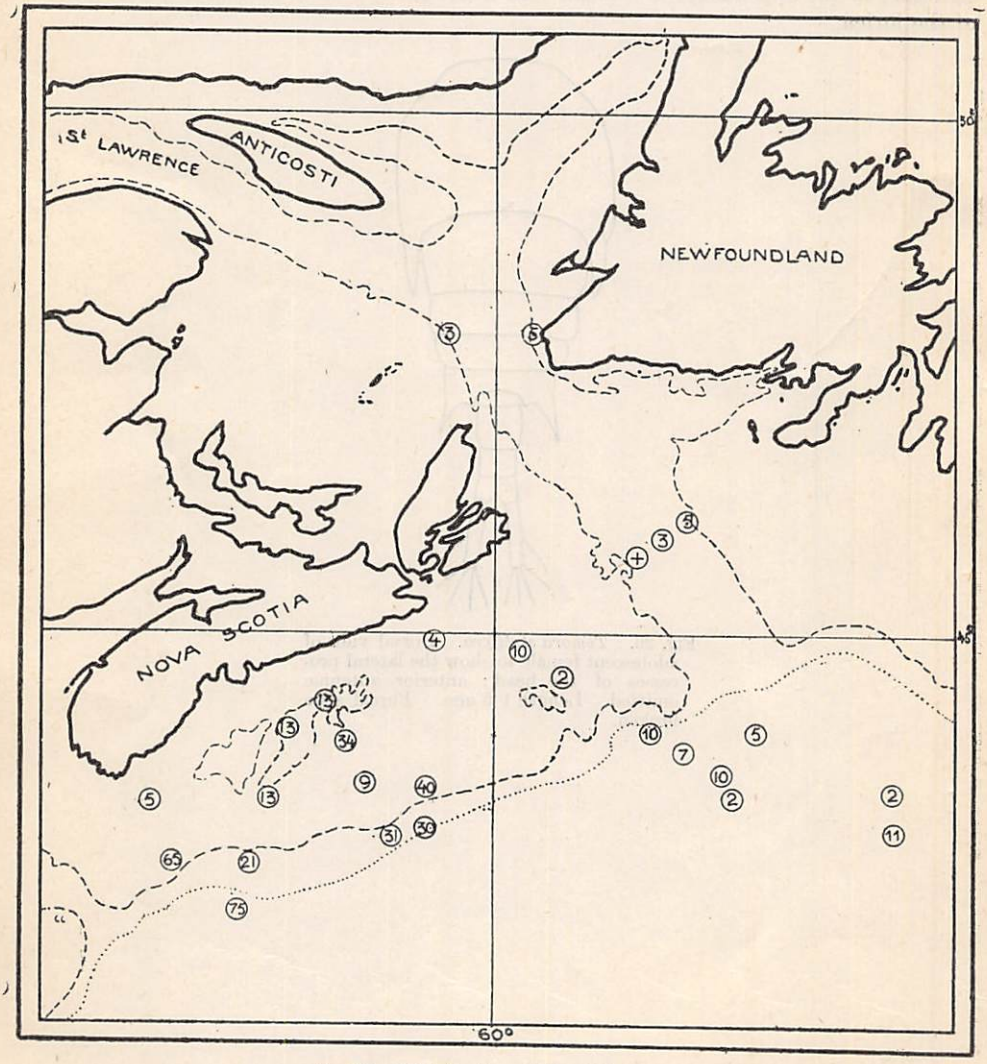

Fig. 27. Distribution of *Metridia lucens*.

16. *Labidocera aestiva* Wheeler.—The capture of this species, which is very abundant in the summer at Woods Hole, at *Princess* station 28 is worthy of special mention. It is given as a generic character of *Labidocera* that there is no rostral lens, while the dorsal lenses are larger in the male than in the female. In the material examined by me the male measures 2mm. in length, the female 2·5mm. The dorsal lenses of the male are larger than those of the female and are contiguous; but in addition to the dorsal lenses a rostral lens is present and clearly seen in ventral view. It will be a simple matter to control this identification by re-examination of examples at Woods Hole.

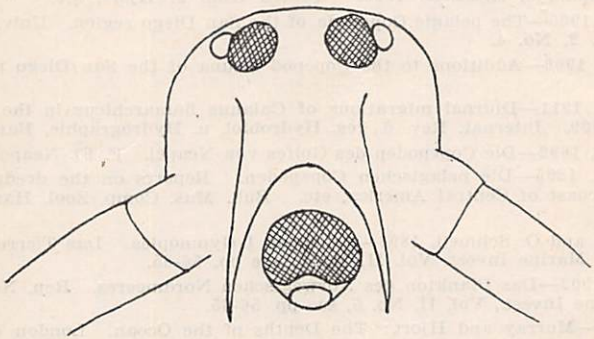

Fig. 28.—*Labidocera aestiva*, female. Ventral view of head from a compressed preparation showing dorsal and rostral lenses. Freehand. "Princess" station 28, 20-0 metres, August 3, 1915.

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TABLE I.—*Princess* Stations 1-4.—Prince Edward Island to Magdalen Islands.

Station.	Date 1915.	Depth.	Haul.	Calanus finmarchicus II.	Calanus finmarchicus III.	Calanus finmarchicus IV.	Calanus finmarchicus V.	Calanus finmarchicus ♀	Calanus finmarchicus ♂	Pseudocalanus elongatus	Centropages hamatus.	Temora longicornis.	Eurytemora herdmani.	Acartia longiremis.	Tortanus discaudatus.	Number counted.	Quantity. c.c.	Locality.	Remarks.
1	11. V.	38 fms.	Oblique. 15 mins.	....	1	+	1	3	1	94	+	+	+	+	+	100	52	35 miles E.N.E. of North Pt., P.E.I.	Abundant phytoplankton. Taken at 9 a.m.
2	11. V.	24 fms.	"	....	6	....	1	4	....	123	1	....	....	....	15	150	100	9½ miles N.W. of Grindstone Island.	Abundant phytoplankton. Taken at 3.20 p.m.
3	9. VI.	11 fms.	20-0m.	....	2	2	1	1	....	1	....	2	....	....	11	20	Scanty.	Northumberland Strait.	Taken at noon. No copepods at surface.
4	9. VI.	"	"	2	7	....	....	....	....	2	1	25	....	....	13	50	"	" "	Taken at 5 p.m.

TABLE II.—Princess Stations 5-13—Miramichi Bay to Anticosti.

Station	Date. 1915.	Depth.	Haul.	Time.	Calanus finmarchicus II.	Calanus finmarchicus III.	Calanus finmarchicus IV.	Calanus finmarchicus V.	Calanus finmarchicus ♀.	Calanus finmarchicus ♂.	Calanus hyperboreus III.	Calanus hyperboreus IV.	Calanus hyperboreus V.	Calanus hyperboreus ♀.	Pseudocalanus elongatus.	Euchæta norvegica.	Centropages hamatus.	Temora longicornis.	Metridia longa.	Eurytemora herdmani	Tortanus discaudatus.	Number counted.	Locality.	Remarks.
5	10 VI	17 fms...	Surface...	9 a.m....	+	13	..	.	..	.	..	..	..	..	9	..	4	16	.	..	58	100	Off Miramichi Bay....	Excess of phytoplankton.
5	"	" ...	30—Om..	" ...	+	55	3	..	..	..	2	..	..	..	24	..	1	16	..	..	19	120	"	Scanty and gelatinous.
6	"	32 fms...	Surface.	12.20 p.m.	+	37	..	..	..	..	..	..	..	..	3	..	1	12	.	..	47	100	27 miles NE	Tortanus plankton.
6	"	" ...	60—Om..	. .....	+	48	11	2	2	..	..	1	..	..	24	.	.	4	7	.	1	100	"	Scanty and gelatinous.
7	"	40 fms...	Surface...	4 p.m....	+	56	1	..	..	..	1	..	..	..	8	..	..	124	..	1	9	200	About 30 miles NE....	Temora plankton.
7	"	" ...	80—Om..	" ...	+	31	1	2	1	..	9	.	1	..	3	..	.	2	..	..	..	50	" ...	Few copepods.
8	"	" ...	Surface...	9 p.m ...	10	29	19	14	9	..	+	+	..	..	14	..	1	3	+	..	1	100	About 40 miles NE. Opposite Chaleur Bay..	C. hyperboreus III counted with C. finmarchicusIII.
8	"	" ...	80—Om..	" ...	+	3	2	11	8	..	10	24	6	+	6	..	..	....	+	..	+	100	" .	110cc. C. hyperboreus plankton.
9	11 VI	100 fms...	Surface...	12.15 a.m.	.	21	.	4	35	..	..	..	..	..	6	22	..	...	6	..	6	100	Deep channel, E. of Gaspè	Euchæta stages III, IV and V.
9	"	" ...	80—Om..	"	..	18	6	11	19	1	16	32	19	.	15	6	..	1	5	..	1	150	"	Euchæta young and adult ♀.
9	"	" ...	100—Om..	"	..	24	5	23	18	1	20	26	4	..	17	43	..	....	18	..	1	200	"	Euchæta III, IV, V, and some ♀ with hypermatophore. C. hyperboreus III includes some II.
10	"	" ..	Surface...	7 a.m....	+	49	8	7	9	..	..	..	..	..	1	10	8	5	..	..	9	100	18 miles S. of E. Cape, Anticosti.	Scanty and gelatinous. Euchæta III, IV, V.
10	"	" ..	100—Om..	" ...	15	12	3	15	..	..	16	14	16	2	4	1	..	1	1	..	..	100	"	
11	"	27 fms...	Surface...	9.30 a.m.	+	18	5	..	4	..	..	1	..	..	13	..	2	....	.	..	7	50	Off E. Cape, Anticosti.	Scanty.
11	"	" ...	50—Om..	"	+	55	5	6	4	..	9	8	5	..	8	..	..	...	.	..	..	100	" ..	Scanty and gelatinous.
12	"	77 fms...	100—Om..	12.30 p.m.	+	46	..	..	..	..	.	..	..	..	3	..	1	....	..	..	..	50	24 miles N. of East Cape, Anticosti.	Radiolarians, phytoplankton and crab larvae at surface.
13	"	100 fms...	100—Om.	4 p.m....	18	1	..	..	.		..	..	..	..	..	1		...	..	..	..	20	Deep channel between Anticosti and N. Shore Mingan channel°	Scanty and gelatinous. Fish eggs present.

TABLE III.—Princess Stations 14-18. North Shore to Bay of Islands.

Station.	Date. 1915.	Depth.	Haul.	Time.	Calanus finmarchicus II.	Calanus finmarchicus III.	Calanus finmarchicus IV.	Calanus finmarchicus V.	Calanus finmarchicus ♀	Calanus hyperboreus III.	Calanus hyperboreus IV.	Calanus hyperboreus V.	Pseudocalanus elongatus.	Euchæta norvegica.	Centropages hamatus.	Temora longicornis.	Tortanus discaudatus.	Halithalestris croni.	Number counted.	Locality.	Remarks.
14	11. VI.	22 fms.	Surface.	7 p.m.	16	4	..	...	....	..	...	....	2	....	1	2	....	....	25	South of North Shore.	Numerous fish eggs.
14	"	"	35-0m.	"	17	5	2	....	..	....	...	....	...	....	1	....	...	....	25	" ..	Fish eggs present.
15	12. VI.	47 fms.	Surface.	9.30 a.m.	4	5	2	1	1	1	....	1	5	....	5	....	....	..	25	45 miles S.E.	"
15	"	"	80-0m.	"	34	25	8	5	1	15	3	1	8	....	..	....	...	....	100	"	50 cc. Radiolaria.
16	"	100 fms.	Surface.	1.15 p.m.	25	40	1	3	9	...	1	....	2	....	17	1	1	....	100	About 30 miles S.E.	
16	"	"	100-0m.	"	7	16	1	24	16	9	7	7	9	2	....	1	1	....	100	" ..	Megacalanoid plankton.
17	"	74 fms.	Surface.	4.30 p.m.	....	+	....	...	+	....	....	....	+	..	+	....	....	....	....	About 25 miles S.E.	Gelatinous; many fish eggs. Hardly any copepods.
17	"	"	100-0m.	"	4	1	....	7	2	....	5	....	1	..	...	...	...	....	20	" ..	
18	"	35 fms.	Surface.	7.30 p.m.	12	3	....	3	...	....	....	....	13	....	114	10	5	90	250	Outside Bay of Islands.	Many fish eggs.
18	"	"	50-0m.	"	5	30	15	5	....	14	5	1	20	...	2	1	...	2	100	" ..	Scanty.

TABLE IV.—Princess Stations 19-26—St. George Bay to Prince Edward Island.

Station.	Date 1915.	Depth.	Haul.	Time.	Calanus finmarchicus II.	Calanus finmarchicus III.	Calanus finmarchicus IV.	Calanus finmarchicus V.	Calanus finmarchicus ♀	Calanus finmarchicus ♂	Calanus hyperboreus II.	Calanus hyperboreus III.	Calanus hyperboreus IV.	Calanus hyperboreus V.	Calanus hyperboreus ♂	Pseudocalanus elongatus.	Euchæta norvegiga.	Centropages hamatus.	Temora longicornis.	Metridia longa.	Tortanus discaudatus.	Number counted.	Quantity in cc.	Locality.	Remarks.
19	13. VI.	45fms.	Surface.	2.45a.m.	3	15	1	2	1	..	..	..	1	1		..	..	19	7	..	..	50	..	Off. St. George Bay, N' land.	Ctenophores and fish eggs.
19	"	"	80-0m.	"	2	16	10	7	4	..	..	16	17	11	..	13	..	2	2	..	..	100	..	" ..	Sagitta and Amphipods.
20	"	100fms.	Surface.	6 a.m.	5	96	60	14	4	..	..	3	4	2	..	8	..	2	2	..	..	200	90	Lt. 48°9′ N.; long. 59°40′ W.	Red Calanoid plankton.
20	"	"	100-0m.	"	1	13	9	17	19	1	..	2	8	11	..	10	4	3	2	..	..	100	..	" ..	Euchæta III.
21	"	"	Surface.	9.45a.m.	1	56	32	2	..	..	..	1	..	..	..	2	..	5	1	..	..	100	10	47°52′ N.; 60°4′ W.....	C. finmarchicus III changing to IV
21	"	"	100-0m.	"	..	13	13	28	15	..	..	5	13	3	1	7	..	1	1	..	..	100	..	"	C. hyperboreus ♀ unique.
22	"	30fms.	50-0m.	1.30p.m.	2	6	4	4	5	..	..	8	10	..	..	10	..	..	..	2	..	51	..	47°34′ N.; 60°39′ W.....	Scanty.
23	"	59fms.	100-0m.	4 p.m.	1	2	12	16	16	2	1	8	25	5	1	7	5	..	..	..	..	100	50	S. slope of Cabot Strait.....	Euchæta III and IV.
24	15. VI.	22fms.	Surface.	7.30a.m.	28	34	2	..	..	..	..	..	..	..	..	34	..	1	..	+	1	100	25	Bank E. Magdelan Islands..	Ceratium and fish eggs.
24	"	"	35-0m.	"	11	50	11	1	..	..	..	4	..	..	..	18	..	+	5	..	+	100		" ..	Microcalanoid plankton.
25	"	38fms.	Surface.	Noon.	32	41	4	3	..	..	..	..	2	..	..	4	..	2	..	1	11	100	50	46°45′ N.; 61°38′ W.....	C. finmarchicus I present.
25	"	"	60-0m.	"	27	16	8	8	9	..	..	1	10	..	..	7	..	1	..	12	1	100	..	"	"
25	"	"	60-25m.	"	4	5	5	9	12	2	..	4	5	3	..	10	..	..	..	21	..	100	..	"	
26	"	22fms.	Surface.	3.30p.m.	3	26	3		3	..	..	..	..	..	..	3	..	3	17	..	42	100	..	46°20″ N.; 62°5′ W.....	Acartia longiremis recorded.
26	"	"	40-0m.	"	..	21	8	7	9	1	..	..	2	1	..	9	..	1	18	5	18	100	..	"	

TABLE V.—Princess Stations 27-39.—Prince Edward Island to Anticosti.

Station.	Date. 1915.	Depth. Metres.	Haul.	Time.	Calanus finmarchicus III.	Calanus finmarchicus IV.	Calanus finmarchicus V.	Calanus finmarchicus ♀.	Calanus finmarchicus ♂.	Calanus hyperboreus III.	Calanus hyperboreus IV.	Calanus hyperboreus V.	Calanus hyperboreus ♀.	Pseudocalanus elongatus.	Euchæta norvegica.	Scolecithrix minor.	Centropages hamatus.	Temora longicornis.	Metridia lenga.	Labidocera æstiva.	Anomalocera patersoni.	Acartia sp.	Tortanus discaudatus.	Number counted.	Quantity in c.c.	Locality.	Remarks.
27	3. VIII.	23 m.	20-0 m.	6 p.m.	..	..	..	..	..	..	..	..	..	..	..	..	+	..	..	..	..	..	+	..	....	Northumberland Strait..	Very scanty.
28	"	19 m.	20-0 m.	Midnight.	..	..	+	+	..	..	..	..	..	..	..	..	12	2	..	8	..	6	42	100	....	" ..	Scanty gray microcalanoid plankton.
29	4. VIII.	32 m.	Surface...	6.30 a.m.	..	5	1	..	..	..	..	..	..	..	..	..	18	18	..	..	..	..	58	100	....	Off Miramichi Bay	Many starfish larvæ.
29	"	"	20-0 m.	"	+	9	4	..	..	..	..	..	..	..	..	..	4	40	3	..	..	..	40	100	....	"	Metridia young.
30	"	66 m.	Surface...	10.30 a.m.	5	44	..	..	..	..	..	..	..	..	..	..	3	3	..	..	..	..	45	100	165	25 miles N.E....	Tortanus mostly ♂.
30	"	"	30-0 m.	"	10	42	..	..	..	..	..	..	..	2	..	..	6	10	..	..	..	..	30	100	6	"	Tortanus many ♀ with spermatophores.
30	"	"	60-0 m.	"	6	55	20	+	+	+	7	+	+	+	..	..	3	7	+	..	..	..	2	100	22	"	
31	"	65 m.	Surface...	2 p.m.	22	49	2	..	..	..	..	..	..	3	..	..	11	3	..	..	..	..	10	100	25	22 miles N.E	Many Pluteus larvæ.
31	"	"	30-0 m.	"	6	24	4	..	..	..	1	..	..	1	..	..	8	4	..	..	..	..	2	50	5	"	
31	"	"	60-0 m.	"	5	54	20	1	..	3	7	+	..	3	3	..	+	4	+	..	..	..	..	100	25	"	Clean pink Calanoids.
32	"	87 m.	Oblique ..	5 p.m.	6	50	25	2	1	..	..	..	..	2	2	..	..	2	..	..	..	..	10	100	300	19 miles N.E.	Pink megacalanoid plankton. Many fish eggs.
32	"	"	30-0 m.	"	5	18	18	1	..	..	..	..	..	1	..	..	+	5	..	..	..	..	2	50	24	"	
32	"	"	85-0 m.	"	13	24	17	3	..	3	10	×	..	15	2	.	+	3	..	..	+	.	10	100	50	"	Euchæta III and IV.
33	"	78 m.	Oblique ..	9.30 p.m.	5	24	53	11	+	..	7	..	..	+	+	..	..	+	+	..	..	..	+	100	350	27 miles N.E.....	Pink megacalanoid plankton.
33	"	"	75-0 m.	"	10	30	20	5	+	2	20	+	+	2	+	..	..	6	+	..	..	..	5	100	40	"	
34	"	405 m.	Oblique .	Midnight.	..	12	26	12	+	..	..	..	..	2	18	..	..	..	18	..	..	..	2	100	350	15 miles N.E.....	Euchæta III, IV and V; ♀ preaent.
34	"	"	130-0 m.	"	+	18	18	6	2	+	14	+	.	5	17	2	..	..	18	..	..	..	+	100	40	"	" "
35	5. VIII.	.....	Surface...	5 a.m.	5	65	25	5	..	..	..	..	..	..	+	..	..	..	..	..	..	..	..	100	200	20 miles N.E.....	Pink Calanoids.
35	"	"	130-0 m.	"	10	20	30	10	..	1	5	..	..	10	12	..	1	1	..	..	..	..	..	100	25	"	Megacalanoid.
36	"	48 m.	Oblique ..	10 a.m.	13	60	7	2	..	1	1	+	..	5	..	..	10	1	..	..	..	..	..	100	70	25 miles N.E.....	Bolinopsis jelly.
36	"	"	60-0 m.	"	10	38	16	5	2	4	+	..	..	10	..	..	10	5	+	..	..	..	.	100	20	"	60 metres wire out.
37	"	75 m.	Oblique ..	1 p.m.	13	40	16	3	+	5	1	..	..	2	..	..	8	12	..	..	..	..	+	100	45	East of Anticosti...	Aurelia present.
37	"	"	80-0 m.	"	10	50	20	2	..	3	3	..	..	2	..	..	3	5	2	..	..	..	+	100	10	"	
38	"	180 m.	Oblique ..	4.30 p.m.	27	25	5	.	+	3	..	..	..	4	..	.	30	6	..	..	+	..	.	100	20	21 miles N.E. by N. ½ N.	Anomalocrea two large ♂.
38	"	"	130-0 m.	"	20	44	3	5	..	3	3	..	..	10	+	..	7	2	3	..	..	..	..	100	12	" ..	Euchæta III and V.
39	"	284 m.	Surface...	7.30 p.m.	25	25	4	1	..	..	..	..	..	..	..	..	35	8	..	..	..	..	2	100	22	10 miles N.....	Shed tentacles of Medusa (Cyanea).
39	"	"	130-0 m.	"	10	50	10	5	..	3	3	..	..	5	+	..	5	1	8	..	..	..	.	100	16	"	Metridia young.

TABLE VI.—Princess Stations 40-44.—North Shore to Bay of Islands.

Station.	Date 1915.	Depth Metres.	Haul.	Time.	Calanus finmarchicus II.	Calanus finmarchicus III.	Calanus finmarchicus IV.	Calanus finmarchicus V.	Calanus finmarchicus ♀	Calanus finmarchicus ♂	Calanus hyperboreus III.	Calanus hyperboreus IV.	Pseudocalanus elongatus.	Euchæta norvegica.	Centropages hamatus.	Temora longicornis.	Metridia longa.	Anomalocera pattersoni.	Tortanus discaudatus.	Number counted.	Quantity in cc.	Locality.	Remarks.
40	5. VIII.	68 m.	Oblique.	Midnight.	+	13	42	24	+	..	+	+	5	..	3	13	..	..	..	100	36	Off North Shore	
41	6. VIII.	189 m.	Surface.	4 a.m.	..	15	30	10	1	1	..	..	..	..	40	3	.	+	..	100	20	27 miles S.E	Schizopod eggs.
41	"	"	130-0m.	"	..	16	24	7	10	..	..	..	2	..	40	1	..	..	+	100	8	"	
42	"	90 m.	Sub-surface.	7.45 a.m.	+	3	32	3	..	..	..	..	..	..	12	+	..	+	+	50	15	21 miles S.E	Very gelatinous.
42	"	"	100-0m.	"	.	+	+	+	..	..	..	..	..	..	+	+	.	+	.	...	..	"	Very exiguous.
43	"	265 m.	Sub-surface.	11.30 a.m.	..	2	3	2	1	..	..	.	..	..	4	..	..	37	1	50	30	29 miles S.E	Chiefly young amphipods.
43	"	"	130-0m.	"	..	14	42	17	4	1	1	7	5	+	3	.	6	+	..	100	10	"	Euchæta and Metridia young.
44	"	157 m.	30-0m.	3 p.m.	..	7	22	21	12	.	..	..	..	..	54	4	+	..	..	100	12	23 miles S.E	
44	"	"	130-0m.	"	..	4	16	25	15	1	1	2	..	..	33	3	+	+	..	100	15	"	

TABLE VII.—Princess Stations 45-50—St. George Bay to Prince Edward Island.

Station.	Date 1915.	Depth metres.	Haul.	Time.	Calanus finmarchicus III.	Calanus finmarchicus IV.	Calanus finmarchicus V.	Calanus finmarchicus ♀	Calanus finmarchicus ♂	Calanus hyperboreus III.	Calanus hyperboreus IV.	Calanus hyperboreus V.	Pseudocalanus elongatus.	Euchæta norvegica.	Centropages hamatus.	Temora longicornis.	Metridia longa.	Metridia lucens.	Labidocera æstiva.	Anomalocera pattersoni.	Tortanus discaudatus.	Number counted.	Quantity in cc.	Locality.	Remarks.
45	12. VII.	375m.	Surface.	3 a.m.	2	28	42	18	5	..	..	..	+	..	+	+	+	5	..	+	..	100	150	Off St. George Bay.....	Sagitta plankton with infiltration of pink Calanoids.
45	"	"	130-0m.	"	+	25	50	13	..	..	..	..	+	+	+	+	10	2	..	..	..	100	30	"	
46	"	over 400m.	Surface.	6 a.m.	12	35	35	15	3	..	..	..	..	..	..	..	..	..	..	..	..	100	250	16 miles W.S.W..... ..	Nearly pure Calanus plankton.
46	"	"	30-0m.	"	4	12	25	7	+	..	..	..	+	2	..	..	..	..	..	..	..	50	15	"	Euchæta IV et V.
46	"	"	130-0m.	"	5	12	60	14	+	..	2	..	+	7	..	..	..	..	..	..	..	100	30	"	Euchæta III, IV, V and one ♀
47	"	"	Surface.	9 a.m.	1	15	12	1	..	..	..	..	..	25	40	..	..	..	..	+	6	100	35	19 miles W.S.W..	Many Echinoderm larvæ in transformation.
47	"	"	130-0m.	"	10	16	36	10	+	2	4	..	+	3	8	8	..	..	..	..	3	100	12	"	Sagitta and Calanoids.
48	"	171m.	Surface.	1 p.m.	..	12	20	1	..	..	..	..	+	+	12	30	..	..	..	..	25	100	100	22 miles W.S.W.....	Echinoderm content as in 47. Oithona present.
48	"	"	30-0m.	"	+	8	20	9	+	..	+	..	+	..	4	30	..	..	..	..	29	100	14	"	Sagitta and Calanoids.
48	"	"	130-0m.	"	5	20	25	4	..	1	8	+	8	+	2	10	+	..	..	..	17	100	24	"	Pink Calanoid plankton.
49	"	70m.	Surface.	6.45 p.m.	..	18	25	1	+	..	+	..	..	+	12	32	..	..	..	..	12	100	60	43 miles W by S ½ S.....	Echinoderms present.
49	"	"	70-0m.	"	..	45	10	1	..	..	15	+	10	..	..	12	7	..	..	..	+	100	40	"	Metridia adult ♂ and ♀
50	"	42m.	Surface.	Midnight.	..	10	10	+	..	..	..	..	+	..	+	70	+	..	..	..	10	100	100	42 miles W.S.W	Sagitta plankton with Copepod infiltration.
50	"	"	40-0m.	"	..	+	+	+	..	..	..	..	+	..	..	+	..	..	+	..	+	...	10	42 miles W.S.W., 46°18′ N., 61°59′ W.	Resembling surface except one Labidocera ♂.

TABLE VIII.—Steam-drifter No. 33.—Gulf of St. Lawrence.

Station.	Date 1915.	Depth Metres.	Haul. Metres.	Time.	Calanus finmarchicus II.	Calanus finmarchicus III.	Calanus finmarchicus IV,	Calanus finmarchicus V.	Calanus finmarchicus ♀.	Calanus finmarchicus ♂.	Calanus hyperboreus II.	Calanus hyperboreus III.	Calanus hyperboreus IV.	Calanus hyperboreus V.	Calanus hyperboreus ♀	Calanus hyperboreus ♂	Pseudocalanus elongatus.	Gaidius tenuispinus.	Euchæta norvegica.	Scolecithrix minor.	Centropages hamatus.	Temora longicornis.	Eurytemora herdmani.	Metridia longa.	Metridia lucens.	Anomalocera patersoni.	Tortanus discaudatus.	Halithalestris croni.	Number counted.	Quantity in cc.	Locality.	Remarks.
3	2. VI	40 m.	15-20m.	8.50 a.m.	5	24	5	12	35	..	..	..	..	..	..	..	6	..	..	..	4	4	..	..	..	..	5	..	100	40	46°18′, 61°59′, between P.E.I. and C. Breton	Horizontal tow.
7	9. VI	20 m.	2-0m.	10.30 a.m.	1	1	1	1	1	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	44	+	50	7	1 mile S. of Souris.....	This is the Souris Tortanus Plankton.
9	9. VI	10 m.	2-0m.	1 p.m.	8	47	28	1	9	1	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	4	..	100	10	46°22½′, 61°55′.....	
11	9. VI	59 m.	2-0m.	6 p.m.	11	7	..	..	..	..	..	..	..	..	..	..	7	..	..	..	5	4	..	..	..	..	66	..	100	20	46°30′, 61°30′.....	
13	9. VI	39 m.	3-0m.	10.30 p.m.	10	10	5	5	25	2	..	..	..	..	..	..	15	..	..	..	5	21	..	..	..	..	2	..	100	20	Close to Cape Breton Island	C. finmarchicus ♀ with spermatophore.
14	10. VI	58 m.	3-0m.	1.50 a.m.	15	20	..	3	10	..	..	..	..	..	..	..	20	..	..	..	2	10	..	+	..	..	20	..	100	50	46°51′, 61°16′.....	Sagitta predominates.
15	10. VI	38 m.	Surface...	5 a.m.	30	45	..	..	2	..	..	..	..	..	..	..	3	..	..	..	5	..	..	..	..	..	15	..	100	5	47°6′, 61°27′.....	Calanus junior plankton.
17	11. VI	39 m.	" ..	8.40 a.m.	22	48	+	..	+	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	100	55	47°12′, 61°23′.....	" "
19	24. VI	90 m.	" ..	5 p.m.	..	2	12	..	17	1	..	..	..	..	..	..	2	..	..	..	6	..	..	..	..	..	12	48	100	35	Gaspé Basin	Gasterosteus aculeatus in surface tow.
21	25. VI	27 m.	5-0m.	7.50 a.m.	..	3	20	5	20	..	1	20	20	..	..	+	..	1	..	..	..	..	..	..	..	..	5	5	160	25	Gaspé Current.....	North of Cape Gaspé.
23	25. VI	355 m.	Surface...	1 p.m.	..	1	9	+	90	+	..	+	+	..	..	..	..	+	..	..	..	..	..	..	..	..	..	+	100	10	Gaspé Channel, 49°3′, 63°58′.....	C. finmarchicus was spawning.
23	25. VI	"	45-0m.	"	..	5	10	2	20	2	1	13	30	..	..	..	8	..	7	2	..	..	..	..	..	..	..	..	100	12	" " ..	C. finmarchicus ♀ of large size.
23	25. VI	"	100-60m.	"	..	..	5	5	23	..	..	22	24	6	..	6	..	8	1	..	..	..	..	..	..	..	..	..	100	15	" " ..	Euchæta III and V.
23	25. VI	"	340-145m.	"	..	..	3	15	2	..	..	15	10	25	10	2	5	7	..	..	..	..	..	6	..	..	..	..	100	90	" " ..	Euchæta III, IV and ♀.
24	26. VI	.....	Surface...	5.25 a.m.	..	..	..	..	+	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	65	Near Anticosti.....	Nearly pure culture of Crab larvæ.
25	26. VI	271 m.	" ...	6.20 a.m.	1	24	12	3	56	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	100	15	49°18½′, 63°42′.....	C. finmarchicus spawning.
26	26. VI	389 m.	" ...	9.35 am.	1	25	4	..	50	..	..	..	..	..	..	..	6	..	..	..	1	..	..	..	..	..	12	1	100	2	49°11½′, 63°50′.....	
26	26. VI	"	30-15m.	"	..	8	23	2	25	+	+	25	2	..	..	12	..	2	..	..	..	..	..	..	..	..	1	..	100	65	"	Euchæta II and III. Deep surface tow 20 minutes.
29	1. VII	41 m.	3-2m.	6 a.m.	..	10	12	+	..	..	..	..	..	..	..	..	25	..	..	..	16	30	..	..	..	..	7	..	100	75	Outside Chaleur Bay..	Numerous fish eggs.
35	7. VII	.....	Surface 15-6m.	6 a.m.	..	..	+	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+	..	..	..	..	+	..	..	50	46°48′, 64°32′.....	Pluteus plankton with Ceratium.
36	8. VII	60 m.	20-8m.	7.30 a.m.	..	15	10	2	..	..	..	..	..	..	..	..	3	..	..	..	12	50	..	..	..	..	8	..	100	110	46°52′ 62°34′.....	Fish eggs and Ceratium.
39	13. VII	.....	9-0m.	.....	..	2	3	..	..	..	..	..	..	..	..	..	6	..	..	..	2	12	+	..	..	..	75	..	100	95	46°22′, 62°3′, 4 miles S. of Souris.....	Clean Tortanus plankton.

48	26. VII	.....	40-0m.	.....	..	8	51	9	3	.	..	2	12	1	..	12	..	..	..	..	..	..	..	..	2	..	100	90	47°35′, 60°36′	.....	Red Calanoid Plankton.
49	27. VII	. . . .	15-0m.	. . ....	..	..	4	3	.	..	..	..	..	..	..	1	.	.	..	1	26	..	..	..	65	..	100	145	47°5′, 61°26′	.....	Pink Microcalanoids.
57	9. VIII	210 m.	200-0m.	3.15 p.m.	..	.	15	10	+	3	..	2	5	5	+	20	.	+	..	+	.	..	40	..	..	..	100	50	Bay of Islands	....	Euchæta ♀ with egg-sac.
58	10. VIII	50 m.	Subsurf'ce	11.10 a.m.	..	..	10	20	8	2	..	..	..	..	..	3	..	..	..	30	24	..	..	..	3	..	100	50	"	.....	Plenty of Aglantha.
59	10. VIII	275 m.	270-0m.	12.50 p.m.	..	..	40	5	+	4	..	5	12	2	2	25	..	+	..	+	+	..	5	..	..	..	100	125	"	....	C. finmarchicus IV plankton.
64	13. VIII	..... .	80-0m.	.....	..	..	32	40	12	5	..	..	4	..	..	..	..	+	..	7	+	..	..	..	..	+	..	100	150	St. George Bay.	.....	C. finmarchicus V plankton.
68	17. VIII	.....	70-20m.	....	..	..	5	30	23	+	..	..	..	..	..	+	..	42	+	..	..	.	..	+	..	..	..	100	350	"	.....	Sagitta and Euchæta plankton.
69	18. VIII	.....	100-20m.	.....	..	..	22	36	8	..	..	2	12	1	.	5	..	1	..	2	5	..	1	3	..	2	.	100	320	47°54′, 60°46′	.....	Schizopods and Calanus.
70	18. VIII	.. ...	2-0m.	.....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	20	..	..	..	75	..	100	100	47°19′, 61°51′	.....	Pluteus and Ceratium.

TABLE IX.—Acadia Stations 2-16.—South East from Nova Scotia.

Station.	Date 1915.	Depth metres.	Haul metres.	Time.	Calanus finmarchicus II.	Calanus finmarchicus III.	Calanus finmarchicus IV.	Calanus finmarchicus V.	Calanus finmarchicus ♀.	Calanus finmarchicus ♂.	Calanus hyperboreus II.	Calanus hyperboreus III.	Calanus hyperboreus IV.	Calanus hyperboreus V.	Calanus hyperboreus ♀.	Rhincalanus nasutus.	Pseudocalanus elongatus.	Undeuchaeta minor.	Euchirella rostrata.	Euchaeta norvegica.	Scolecithrix minor.	Centropages hamatus.	Temora longicornis.	Pleuromamma abdominalis.	Pleuromamma xiphias.	Pleuromamma robusta.	Pleuromamma borealis.	Metridia longa.	Metridia lucens.	Heterorhabdus norvegicus.	Candacia armata.	Number counted.	Quantity in c.c.	Remarks.
*2	29. V.	60	50-25	11 a.m.	..	..	....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	....	15	Outside Halifax harbour.
3	"	144	0	2.30 p.m.	..	33	37	4	26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	100	20	20 miles S. 64° E.
3	"	144	100-50	"	5	10	15	9	9	1	+	12	30	2	..	..	6	..	..	1	..	..	..	..	..	..	..	..	..	..	..	100	30	"
4	"	171	30-0	7.30 p.m.	..	10	17	6	13	..	..	..	2	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	50	6	34 miles S. 68° E.
4	"	171	80-40	"	..	2	13	8	3	..	..	..	9	6	..	..	3	..	..	..	..	..	..	..	..	..	..	6	..	..	..	50	11	"
4	"	171	150-100	"	1	5	19	12	6	1	..	1	10	21	2	..	12	..	..	1	..	..	..	..	..	..	..	6	3	..	..	100	45	"
5	30. V.	72	0	1.00 a.m.	..	50	110	30	10	..	+	..	..	..	..	..	+	..	..	+	..	..	..	..	..	..	..	..	+	..	..	200	330	30 miles S. 74° E.
5	"	72	60-0	"	.	9	13	16	3	..	.	2	4	..	..	..	2	..	..	..	..	..	1	.	.	..	..	..	..	..	..	50	29	"
6	"	45	0	5.45 a.m.	..	3	18	11	3	..	..	1	1	..	..	.	5	..	..	..	..	6	2	.	..	..	..	..	..	..	..	50	scanty	29 miles S. 68 E.
6	"	45	40-0	"	..	7	19	11	..	..	..	.	1	..	..	..	10	..	..	..	..	..	2	..	..	..	..	..	..	..	..	50	"	"
7	"	108	0	10 a.m.	1	1	3	3	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	..	.	..	..	..	..	..	10	5	30miles in same line.
8	"	50	0	12.50 p.m	..	16	24	3	2	..	..	..	..	..	..	..	3	..	..	..	..	2	..	..	..	..	..	..	..	..	..	50	16	16 miles N. 22° E.
8	"	50	40-0	"	..	5	12	..	1	..	..	..	1	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20	5	"
9	"	104	0	4.45 p.m.	..	3	35	39	18	..	..	2	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	100	20	30 miles S. 79° E.
9	"	104	25-0	"	..	8	22	12	5	..	..	..	..	1	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	50	6	"
10	"	732	0	7.15 p.m.	..	2	20	65	6	..	..	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	100	800	15 miles S. 81° E.

11	"	2000	0	10.45 p.m.	..	1	42	23	4	..	..	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	4	..	..	..	100	800	20 miles S. 82° E.
11	"	2000	70–0	"	..	..	18	20	3	..	..	3	10	..	..	..	1	..	1	30	1	..	..	..	..	1	..	11	1	..	..	100	70	"
12	31. V.	2000	0	4 35 a.m.	..	7	52	30	..	..	..	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	2	..	..	..	100	250	35 miles S. 79° E.
12	"	2000	100–0	"	..	1	28	21	8	..	..	5	10	12	..	..	1	..	..	14	..	..	..	..	..	..	..	..	..	..	..	100	70	"
13	"	2000	70–0	8.45 a.m.	..	5	16	22	4	..	..	.	2	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	50	22	20 miles S. 81° E.
†14	"	2000	0	12.50 p.m.	..	..	....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	....	5	36 miles S. 78° E.
14	"	2000	200–0	"	..	..	20	32	24	.	..	1	3	.	..	..	..	..	5	9	1	..	.	..	..	..	..	1	2	2	..	100	60	"
15	"	2000	0	7.15 p.m.	..	..	18	70	2	..	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	100	550	52 miles S. 78° E.
15	"	2000	100–0	"	..	..	4	70	10	..	..	..	..	..	..	..	..	1	3	12	..	..	..	..	..	..	..	..	..	..	..	100	175	"
16	1. VI.	2000	0	1.45 a.m.	..	2	10	54	16	..	..	..	..	..	..	2	..	2	..	14	..	..	..	..	..	..	..	..	..	..	..	100	120	51 m. S. 74°E. One *Calanus gracilis*
16	"	2000	200-0	"	..	..	...	10	3	..	..	..	..	+	+	14	..	..	14	29	2	..	..	1	2	5	7	..	11	.	2	100	75	" 42°53′ N., 54°9′ W.

* Copepods consist of a mixture in subequal numbers of Calanus finmarchicus and C. hyperboreus. † Scanty sample consisting largely of Calanoid exuviæ.

TABLE X.—Acadia Stations 17-36.—Around and upon the Newfoundland Banks, and Cabot Strait.

Station.	Date. 1915.	Depth. Metres.	Haul. Metres.	Time.	Calanus finmarchicus II.	Calanus finmarchicus III.	Calanus finmarchicus IV.	Calanus finmarchicus V.	Calanus finmarchicus ♀.	Calanus hyperboreus III.	Calanus hyperboreus IV.	Calanus hyperboreus V.	Calanus hyperboreus ♀.	Calanus tenuicornis.	Rhincalanus nasutus.	Pseudocalanus elongatus.	Ætideus armatus.	Euchirella rostrata.	Euchæta norvegica.	Scolecithrix minor.	Centropages hamatus.	Temora longicornis.	Metridia longa.	Metridia lucens.	Heterorhabdus norvegicus.	Tortanus discaudatus.	Number counted.	Quantity in c.c.	
*17	1. VI.	2,000	0	9 a.m.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	43°30′50″ N., 54°12′50″ W. 37 miles N. 4° W. from Station 16.
17	"	"	200-0	"	.	.	2	12	.	.	.	.	.	5	5	.	4	15	5	.	.	.	.	2	.	.	50	10	" "
18	"	"	0	4.30 p.m.	.	5	39	4	1	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	50	60	50 miles N. 5° W.
19	"	"	0	8.15 p.m.	.	2	23	17	2	.	.	.	.	.	.	1	.	.	3	.	.	.	.	.	.	.	50	100	24 miles N. 2° W. Amphipod plankton.
20	2. VI.	90	0	1 a.m.	.	11	9	9	3	.	.	.	.	.	.	.	.	.	.	.	3	15	.	.	.	.	50	30	24 miles N. 4° W. Green Banks.
21	"	115	0	3.30 a.m.	.	1	1	4	3	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	10	45	29 miles N. 15° W. Copepods scarce.
**22	"	75	0	7.15 a.m.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	24 miles N. 23° W.
***23	"	99	0	10.35 a.m.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19 miles S. 52° W. Eastern end of St. Pierre Bank.
23	"	99	70-0	"	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	" "
†24	"	118	0	2.15 p.m.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	29 miles S. 41° W. Eastern end of St. Pierre Bank.
24	"	118	100-0	"	2	5	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	25	29 miles S. 41° W. Copepods very scarce.
††25	"	122	0	5.30 p.m.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	27 miles S. 38° W.
25	"	122	120-0	"	.	7	7	12	7	.	1	.	.	.	9	+	+	.	+	2	4	.	1	.	.	50	15	"
26	"	500	0	10 p.m.	.	9	18	39	8	.	.	.	.	.	1	.	.	21	.	.	.	3	1	.	.	100	400	32 miles S. 41° W. Between Banquereau and St. Pierre.
26	"	500	100-0	"	1	3	5	38	15	2	5	6	.	.	2	.	1	10	1	.	.	8	2	1	.	100	35	" "
27	3. VI.	500	0	2 a.m.	.	10	20	50	6	.	.	.	.	.	+	.	.	13	.	+	.	1	.	.	.	100	105	31 miles S. 40° W. S.E. of Banquereau.
28	"	500	0	6 a.m.	.	17	34	16	20	.	.	.	.	.	4	.	.	3	.	4	.	.	.	.	2	100	85	22 miles N. 75° W. Eastern slope of Banquereau.
28	"	500	100-25	"	.	2	6	24	7	15	21	16	.	.	5	.	.	+	.	.	.	.	.	.	.	100	45	" "
†††29	"	57	0	10.50 a.m.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	32 miles N. 73° W. Banquereau.
29	"	57	55-0	"	.	2	2	1	1	1	1	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	10	5	" "
‡30	"	126	0	3 p.m.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	31 miles N. 52° W. Banquereau.
30	"	126	100-0	"	1	2	3	2	1	12	14	1	.	.	13	.	.	.	.	.	.	1	.	.	.	.	50	10	" "
31	"	82	0	7.30 p.m.	4	9	7	1	1	7	8	1	.	.	2	.	.	.	.	.	.	.	.	.	.	.	50	50	39 miles N. 18° W. Misaine Bank.
31	"	82	75-0	"	.	5	3	10	2	10	10	4	1	.	4	.	.	.	.	.	.	1	.	.	.	.	50	45	" "
32	"	153	0	11.20 p.m.	1	4	3	3	36	.	.	.	.	.	2	.	.	.	.	.	.	1	.	.	.	.	50	100	34 miles N. 17° W. Off Misaine Bank. Aglantha plankton.
32	"	153	100-25	"	7	18	3	18	36	7	3	3	1	.	4	.	.	.	.	.	.	.	.	.	.	.	100	100	" "
34	4. VI.	360	0	7.45 a.m.	.	11	27	4	3	.	.	.	.	.	.	.	.	.	.	2	2	.	.	.	1	.	50	30	46°40′ N., 59° W. Outside Cabot Strait.
34	"	360	100-0	"	1	9	12	8	1	6	7	.	.	.	4	.	.	.	.	2	.	.	.	.	.	.	50	90	46°40′ N., 59° W. Sagitta plankton.
35	"	450	0	11.45 a.m.	.	9	10	12	13	.	.	.	.	.	2	.	.	.	.	4	.	.	.	.	.	.	50	30	33 miles N. 45° E.

35	"	450	125–25	"	..	3	3	31	16	9	12	13	..	..	..	7	..	..	4	..	1	1	..	..	..	..	100	....	33 miles N. 45° E. C. hyperboreus II present.
36	"	226	0	3.30 p.m.	6	40	10	7	5	..	..	..	..	..	..	14	..	..	..	..	15	3	..	..	..	..	100	15	Off Burgeo Islands, 50 miles east of Pointe Basque
36	"	226	100–15	"	..	8	11	15	7	1	3	2	..	..	..	2	..	..	1	..	..	..	..	..	..	..	50	Scanty.	" "

* Scanty sample consisting largely of Calanoid exuviæ; compare Station 14. ** Beroë and Aglantha; no Copepods. *** No Copepods. Scanty gelatinous plankton. † Ctenophores; no Copepods. †† Beroë and Aglantha; no Copepods. ††† Scanty gelatinous plankton; no Copepods. ‡ Ctenophores; no Copepods.

TABLE XI—Acadia—

Station.	Date. 1915.	Depth. Metres.	Haul. Metres.	Time.	Calanus finmarchicus III.	Calanus finmarchicus IV.	Calanus finmarchicus V.	Calanus finmarchicus.	Calanus finmarchicus ♂.	Hyperboreus III and IV.	Hyperboreus V and ♀.	Gracilis.	Minor.	Vulgaris.	Eucalanus attenuatus.	Elongatus.	Crassus.	Rhincalanus nasutus.	Cornutus.	Clausocalanus arcuicornis.	Pseudocalanus elongatus.	Aetideus armatus.	Gaidius tenuispinus.
37	21 VII	62	0	5 p.m.	8	31	17	32	12	..	.	..	..	..	..	..	..	..	..	..	..	..	..
37	"	62	60–0	"	11	28	21	18	3	18	1	..	..	..	..	..	..	..	..	..	+	..	..
38	"	170	0	8 p.m.	28	55	14	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
38	"	170	100–0	"	30	30	20	7	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..
38	"	170	150–0	"	19	25	13	3	6	12	7	..	..	..	..	..	..	..	..	..	..	..	..
39	"	95	0	11 p.m.	7	36	10	0	4	.	..	..	..	..	..	..	..	..	..	..	..	..	..
39	"	95	25–0	"	10	48	15	24	1	1	.	..	..	..	..	..	..	..	..	..	..	..	..
39	"	95	100–0	"	4	40	26	19	1	8	+	..	..	..	..	..	..	..	..	..	..	..	..
40	22 VII	134	0	2 a.m.	..	..	2	30	..	.	.	..	..	..	..	..	..	..	..	..	..	..	..
40	"	134	125–0	"	..	2	10	5	8	4	3	..	..	..	..	..	..	..	..	..	1	..	..
*41	"	360	0	5.30 a.m.	..	..	.	..	..	.	.	..	..	..	..	..	..	..	..	..	..	..	..
*41	"	360	100–0	"	..	..	.	..	..	.	.	..	..	..	..	..	..	..	..	..	..	..	..
41	"	360	200–0	"	..	..	.	..	..	.	.	..	..	..	..	..	..	+	..	..	..	..	..
**42	"	1000	0	9 a.m.	..	..	.	..	..	.	.	..	..	..	..	..	..	..	..	..	..	..	..
42	"	1000	200–0	"	..	..	.	..	..	.	.	+	.	..	..	..	..	+	..	+	..	..	..
†43	"	1000	0	11.45 a.m.	..	..	.	..	..	.	.	..	..	..	..	..	..	..	..	..	..	..	..
44	"	1000	0	3 p.m.	..	..	.	..	..	.	.	.	18	..	2	.	1	14	.	3	..	..	..
44	"	1000	270–0	"	..	..	.	..	..	.	.	4	5	10	5	3	+	20	+	+	..	+	..
††45	"	1000	0	8.15 p.m.	..	..	.	..	..	.	.	..	..	..	..	..	..	..	..	..	..	..	..
45	"	1000	90–0	"	..	..	.	3	..	.	.	..	..	..	..	..	..	..	..	..	..	..	..
45	"	1000	270–0	"	..	..	.	1	..	.	.	..	..	..	..	..	..	+	..	..	..	..	..
46	23 VII	1000	0	1 a.m.	..	..	.	..	..	.	.	..	..	..	..	..	..	..	..	..	..	..	..
46	"	1000	270–0	"	..	..	+	..	+	.	.	..	..	..	..	..	..	..	..	+	..	..	+
47	"	140	0	6.30 a.m.	4	33	4	5	1	.	.	..	..	..	..	..	..	..	..	..	..	..	..
47	"	140	125–0	"	..	9	64	10	1	3	.	..	..	..	..	..	..	..	..	..	..	..	..
‡48	"	248	0	11 a.m.	..	..	.	..	..	.	.	..	..	..	..	..	..	..	..	..	..	..	..
48	"	248	230–0	"	..	10	24	14	..	15	15	..	..	..	..	..	..	..	..	..	..	..	..
49	"	126	0	3.40 p.m.	20	60	6	1	..	.	.	..	..	..	..	..	..	..	..	..	4	..	..
49	"	126	125–0	"	10	32	40	6	..	8	+	..	..	..	..	..	..	..	..	..	2	..	..
50	"	151	0	7.30 p.m.	10	30	28	12	..	.	.	..	..	..	..	..	..	..	..	..	9	..	..
50	"	151	145–0	"	6	15	41	5	1	5	+	..	..	..	..	..	..	..	..	..	4	..	..
51	"	131	0	10.30 p.m.	3	17	52	6	3	.	.	..	..	..	..	..	..	..	..	..	2	..	..
51	"	131	125–55	"	5	17	34	2	+	2	.	..	..	..	..	..	..	..	..	..	2	..	..
52	24 VII	99	0	1.45 a.m.	10	50	14	18	..	.	.	..	..	..	..	..	..	..	..	..	..	..	..
52	"	99	90–0	"	3	32	40	9	2	4	.	..	..	..	..	..	..	..	..	..	1	..	..
53	"	95	0	4.45 a.m.	21	57	3	6	3	.	.	..	..	..	..	..	..	..	..	..	..	..	..
53	"	95	90–0	"	20	38	30	3	2	5	.	..	..	..	..	..	..	..	..	..	1	..	..
54	"	1000	0	7.40 a.m.	..	..	.	..	..	.	.	..	..	..	..	..	..	..	..	..	..	..	..
54	"	1000	270–0	"	+	10	6	.	.	.	.	..	..	..	..	..	..	..	..	..	..	..	..
‡‡55	"	1000	.....	10.30 a.m.	..	..	.	..	..	.	.	..	..	..	..	..	..	..	..	..	..	..	..
56	"	1000	375–0	2.20 p.m.	..	+	.	..	..	.	.	..	+	..	+	..	..	+	..	..	..	..	..

* Very scanty, copepods nil. ** Very scanty. †Very scanty; Phronima and Euthemisto: no copepods. †† Phronima plankton; no copepods. ‡ Nil. ‡‡ Very scanty at all depthts.

Stations 37-56—July, 1915.

Undeuchæta minor.	Major.	Euchirella rostrata.	Pulchra.	Messinensis.	Acadiana.	Euchæta norvegica.	Marina.	Scoleithrix minor.	Danæ.	Ovata.	Cuneifrons.	Centropages hamatus.	Bradyi.	Temora longicornis.	Stylifera.	Pleuromamma abdominalis.	Xiphias.	Robusta.	Borealis.	Metridia longa.	Lucens.	Heterorhabdus norvegicus.	Candacia bipinnata simplex. varicans, etc.	Labidocera.	Pontellina plumata.	Anomalocera patersoni.	Acartia clausi and danæ.	Tortanus discaudatus.	Podoplea.	Number counted.
..	..	..	..	..	..	..	..	..	..	..	..	+	..	..	..	..	..	..	..	....	....	....	....	....	....	....	....	+	....	100
..	..	..	..	..	..	..	..	..	..	..	..	+	..	+	..	..	..	..	..	....	+	....	....	....	....	....	....	....	....	100
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	....	....	....	....	....	....	....	....	....	....	100
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TABLE XII—Prince Stations 1—4 Near St. Andrew's, New Brunswick, September 1915—Collected by Dr. A. G. Huntsman.

Station.	Date 1915.	Depths fathoms.	Haul.	Time.	Calanus finmarchicus I.	Calanus finmarchicus II.	Calanus finmarchicus III.	Calanus finmarchicus IV.	Calanus finmarchicus V.	Calanus finmarchicus ♀	Calanus finmarchicus ♂.	Calanus hyperboreus III.	Calanus hyperboreus IV	Calanus hyperboreus V.	Pseudocalanus elongatus.	Euchæta norvegica.	Centropages typicus.	Centropages hamatus.	Temora longicornis.	Eurytemora herdmani.	Metridia longa.	Metridia lucens.	Acartia clausi.	Tortanus discaudatus.	Halithalestris crom.	Number counted.	Locality.
1	14. IX	18	Surface.	3.45 p.m.	..	..	10	8	62	6	4	..	..	..	10	..	..	..	..	..	..	..	..	..	..	100	Off Eastport; bright sun, calm.
1	14. IX	18	5–10	3.45 p.m.	..	..	2	7	60	12	3	..	3	1	12	..	..	..	..	..	..	..	..	..	..	100	" " deep tow.
1	14. IX	18	Vertical.	3.45 p.m.	.	..	3	3	51	14	3	..	2	..	21	1	..	..	..	..	..	2	..	..	..	100	" " from bottom up.
2	14. IX	50–70	Surface.	4.30 p.m.	+	..	15	10	15	1	1	..	..	..	54	..	3	..	..	..	..	..	..	1	..	100	Off Head Harbour Island.
2	14. IX	50–70	55–0	4.30 p.m.	..	..	..	3	55	12	3	..	..	..	20	2	..	..	..	..	..	5	..	..	..	100	" "
*3	15. IX	100	Surface.	10 a.m.	..	.	..	..	..	..	.	..	..	..	.	..	..	..	..	..	..	..	..	..	..	....	11½ miles SSE. of Grand Manan.
3	15. IX	100	8–10	10 a.m.	..	1	50	17	4	4	+	..	..	..	2	..	6	6	10	..	..	..	..	..	..	100	" " deep tow, 15 minutes
3	15. IX	100	100– 0	10 a.m.	..	..	10	5	65	5	..	1	5	1	+	1	..	+	..	..	3	4	..	..	..	100	" " vertical haul.
4	15. IX	18	3– 6	5.30 p.m.	..	..	6	4	32	7	4	..	..	..	20	..	..	..	..	..	..	..	25	2	..	100	Passamaquoddy Bay.
4	15. IX	18	18– 0	5.30 p.m.	.	..	7	2	40	6	1	..	..	..	24	..	1	1	1	5	2	..	5	4	1	100	" scanty.

* Schizopod eggs, with very few Copepods.